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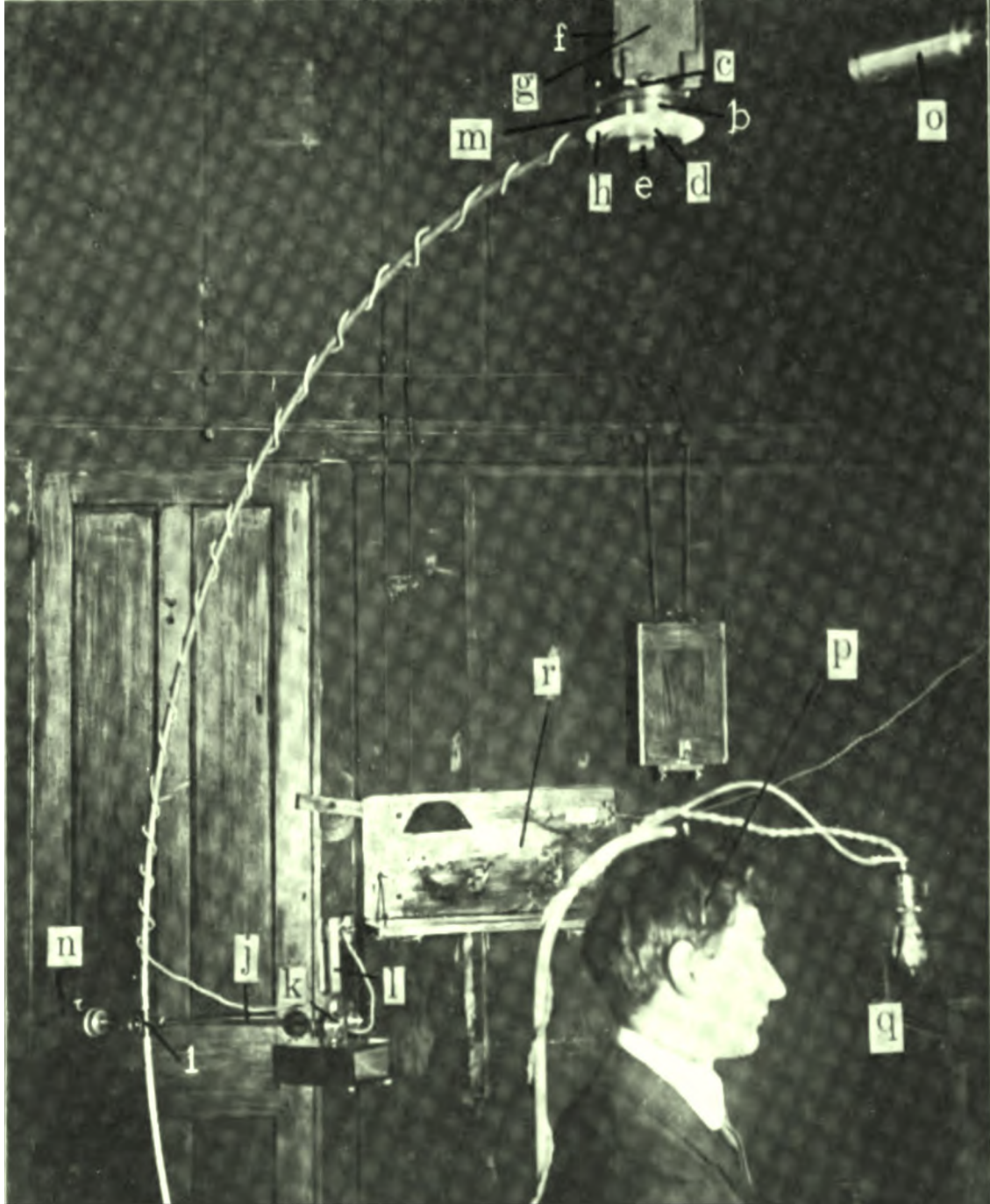
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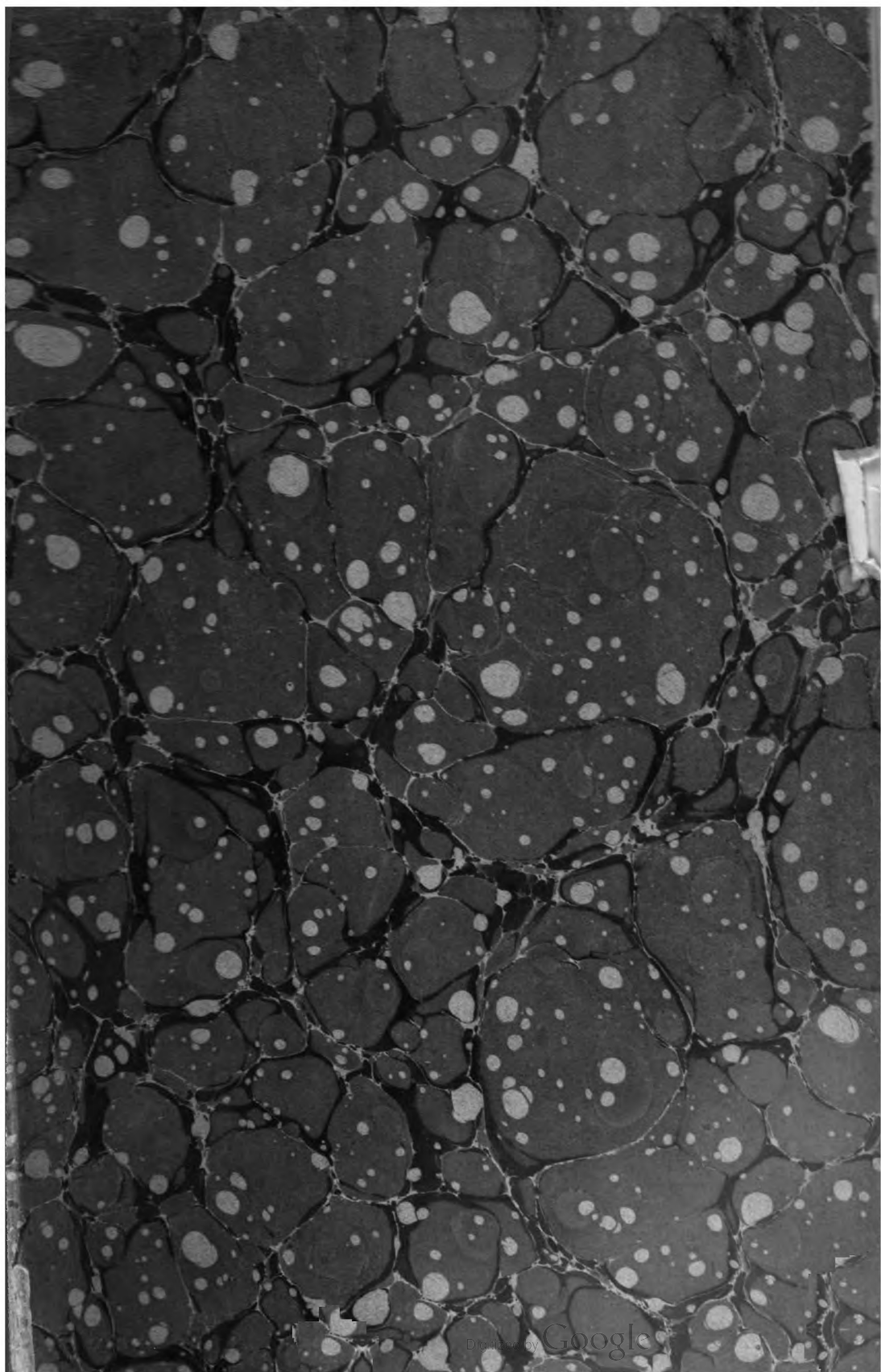


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Granville Stanley Hall, Edward Bradford Titchener



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No. 1

THE RELATIVE LEGIBILITY OF DIFFERENT FACES OF PRINTING TYPES

By BARBARA ELIZABETH ROETHLEIN, A.M., Clark University

Communicated by JOHN WALLACE BAIRD

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I. INTRODUCTORY

The aim of the investigation which is here reported was to determine the relative ease or difficulty with which various 'faces'¹ or forms of printed letters can be read; and to discover what relationship obtains between legibility and certain definite modifications of 'face.' A number of typically different faces of type were selected for investigation; and our experimental procedure consisted essentially in determining to what extent the legibility of each face was affected—both when the letters were presented in isolation and in groups—by the introduction of unfavorable conditions for

¹ The term 'face' is employed here and throughout this paper in the sense in which it has come to be used by printers and type-founders. It is customary to group the numerous variants of letter-form into families,—Caslon, Cheltenham, Jenson, Ronaldson, etc.,—and to speak of each family or typical variant from the common letter-form as a 'face.'

reading. The present paper will deal only with 'type-faces'; the question of the part which is played by printing papers and printing inks will be discussed in a later paper.

At the time when the art of printing from individual or moveable types was first introduced, the forms of the letters of the alphabet were few in number and exceedingly crude in design. The use of 'black letter' had been popularized by generations of manuscript writers; and the early printers were content to appropriate those letter-forms which they found to be in current use. But within a few decades designers and draughtsmen set themselves the task of simplifying and improving the existing forms of letters; and, indeed, it seems probable that the Roman 'faces' were introduced about the year 1465, and the Italic 'faces' some thirty-five years later. The ingenuity of many generations of mediaeval and modern designers has produced a multitude of variants of letter-forms, many of which are familiar to every reader (a, a, a, a, a; g, g, g, g, g). Hundreds of different 'faces' of type have been designed and put upon the market; and while it is true that certain of these 'faces' are employed only for purposes of ornamentation and display, yet an enormous variety of letter-forms is to be found in our books and magazines. Every reader has observed that all of these variants of letter-form are not equally legible—an observation which raises the theoretical question: What are the factors upon which legibility depends? And the practical question: How should one proceed if one set out to improve the legibility of printed letters?

II. HISTORICAL

Psychologists have been engaged these many years in an investigation of the act of reading in its various aspects. But there is a singular dearth in the literature so far as the specific topic of the present investigation is concerned.

More than forty years ago, Exner (17) and Baxt (2) undertook to measure the brief period of time which is necessary for the perception of visual objects (letters, words); and in 1885 Cattell (6, 7, 8) continued the investigation of the same problem. Baxt had reported that, under his most favorable conditions of illumination, it was possible to read two or three letters of a total group of seven when they were exposed for one one-hundredth of a second. Cattell devised a falling-screen apparatus which enabled him to vary and to measure his exposure-times. He found that the differences in the times which are necessary for the recognition of isolated letters, whether upper case or lower

case,² whether Latin or German, are of negligible magnitude. When the exposure-time was very brief, it was found that the letters were not always read correctly. A record of the percentage of correct readings of the various letters, when presented under constant and uniform conditions, enabled Cattell to determine the relative legibility of the letters. The order of legibility (descending) was found to be: W Z M D H K N X A Y O G L Q I S C T R P B V F U J E and d k m q h b p w u l j t v z r o f n a x y e i g c s,—W being read correctly in 89 per cent. of the trials, E in 23 per cent.; d in 87, and s in 28 per cent.

Sanford (35) employed a similar method, but obtained a somewhat different result; his order was (for Snellen type, lower case):

m w d q v y j p k f b l i g h g r x t o u a n e s c z

Sanford also determined the relative legibility of the same letters by a distance method, and obtained the following result:

w m q p v y j f h r d g k b x l n u a t i z o c s e

Sanford also tested alphabets representing two other letter-forms,—a modern face, and a bold oldstyle face. The modern face letters were recognized in the following order (distance test):

d p q m y k n w o g v x h b j l i a t u z r s c f e

The oldstyle letters fell into the following order (tested by the method of brief exposure):

m w p q v y k b d j r l o n i g h u a t f s x z c e

Finzi (18) employed the method of brief exposure, presenting a group of nine letters at each exposure. From the percentage of misreadings of each letter he computed the order of legibility as follows:

P U A Q X T D S E W M V Y Z H C N F L R G B K O I,
the percentage of errors ranging between .8 for P, and 7.8 for I. The particular type or letter-form which Finzi employed is not specified in his paper.

Griffing and Franz (21) investigated the influence of size and form of letter upon legibility. Their experiments comprised a fourfold test: What is the difference in the rapidity with which small print and large print can be read (five-point and twelve-point, both Roman)? How many letters of each of these two sizes can be read in a single brief exposure? How long must letters of each size be exposed

² The term 'upper case' will be used throughout to designate the capital letters, and 'lower case' to designate the small letters.

in order to insure their correct reading? What intensity of illumination is necessary for the recognition of letters of various forms and sizes,—Roman letters, .8 mm. and 1.6 mm. high; Gothic letters, .9, 1.6, 3.1, and 5.0 mm. high? These investigators found that their larger types were, in every instance, more legible than their smaller types; and that Gothic letters were more legible than Roman letters.

Besides these experiments which have just been described, numerous attempts have been made to investigate other factors which have to do with the act of reading. The nature and the extent of the eye-movements by means of which the reader follows the printed line have been examined and measured by Huey (22, 23, 24), Dodge (13, 14, 15), Erdmann and Dodge (16), Dearborn (10), and others. It has been established that the movement of the reader's eyes does not proceed gradually and continuously across the page, in any such fashion as, for example, a meteor moves across the sky. Typical eye-movements consist of a succession of alternate leaps and pauses; nor is the movement always in a forward direction, because it frequently happens that one's eye-movement proceeds backward, i.e., to the left, from an intermediate fixation-point. The number of pauses may vary from two to seven in a line whose length is twenty centimeters; but the usual distance between successive fixation points or pauses is approximately 2 cm. It seems probable that no words are seen while the eyes are in movement; and that the act of reading a printed line consists of a series of interrupted glimpses, during each of which one reads a small section which extends to the right and to the left of the fixation-point.

This discovery makes it seem probable that a considerable part of the printed line is imaged, not upon the fovea, but upon para-foveal regions of the retina. And the capacity of these paracentral regions to distinguish the forms of letters becomes an important topic for investigation. This problem has, indeed, been attacked by Kirschmann (28) and by Dockeray (12); but further investigation is needed before one can make any definite statement regarding the legibility of letters in indirect vision.

Numerous other investigations of the problems of reading have been made by Babbage (1), Becher (4), Goldscheider and Müller (19), Javal (26, 27), Maire (31), Messmer (32), Pillsbury (33), Quantz (34), Schumann (37), and Zeitler (40); but it seems more appropriate to discuss their results in connection with our own findings, than to summarize them in this section.

III. EXPERIMENTAL

A. ISOLATED LETTERS

a. Materials and Apparatus

The materials which were employed in the present investigation were sheets of printed letters; and the apparatus consisted of a mechanism by means of which these letters could be presented at a variable distance from the observer.

When the investigation was first undertaken, we made a careful examination of the various faces of type which are listed in the sample-books of the American Type Founders Company.³ We selected fifty faces of type,—comprising some thirty ordinary faces, together with such variants as italic, bold, condensed, expanded and various combinations of these variants.

In these earlier experiments, it was decided to employ the method of brief exposure; and an apparatus was devised which provided for a succession of exposures, each one one-thousandth of a second in duration. The series of exposures of any given letter was terminated by the depression of a key by the observer; and an automatic counting device recorded the number of exposures which had been necessary for the reading of the letter. For certain technical reasons this apparatus and mode of procedure were abandoned after a number of preliminary experiments had been made; and the distance test was substituted.⁴

The apparatus, by means of which we obtained the results on which this paper is based, consisted of a long bench along which moved a sliding carriage containing the letters to be read. The bench was 440 cm. long and 15 cm. wide. Its

³ The author is indebted to the American Typefounders Company, Jersey City, for a liberal donation of types and of prints, without which the investigation would have been impossible. Especial thanks are due to Messrs. Frank B. Berry, L. B. Benton and Morris Benton of that firm for valuable suggestions regarding letter-forms and regarding the interpretation of our results. We are also under obligation to Dr. H. L. Koopman, of Brown University, and to Mr. C. Chester Lane of the Harvard Press; Mr. L. D. Evans of the Riverside Press, Cambridge, Mass., has furnished us with valuable data concerning compositors' errors and proof-readers' errors.

⁴ It is a well-known fact that concentration of attention has a very pronounced effect upon reaction-time, and that the duration of the reaction varies with variations in degree of concentration. It seemed difficult, even impossible, to maintain the same degree of concentration through thousands of readings of letters; and, in the absence of a control of this exceedingly influential factor, the results of our tachistoscopic experiments seemed wholly unreliable. For this reason the tachistoscope was abandoned, and a method which consisted in presenting the letters at variable distances was substituted.

proximal end was 78 cm., and its distal end 63 cm. above the floor, so that the observer was able to assume the primary position of regard throughout. The higher end of the bench was provided with a vertical support, which carried a head rest,—the hood of a stereoscope. This device enabled the observer to assume and to maintain a constant position in relation to any point on the scale upon the side of the bench.

The carriage which moved along the bench consisted of a box 55 cm. high, 40 cm. wide, and 25 cm. deep. The front of the box had been cut away; and the back consisted of a wooden wall against which the sheet of printed letters was attached and held in place by a sheet of glass. The back wall of the box was illuminated by a number of electric lamps, so arranged that the whole surface of the sheet of letters was uniformly illuminated. To the side of the carriage was attached an indicator, which just cleared a metric scale upon the side of the bench; this device enabled the experimenter to ascertain the distance of the sheet of letters from the eye of the observer at any given setting of the carriage.

The sheets upon which the isolated letters were printed were 21 cm. wide and 36 cm. long; and the paper of all of the sheets was of the same quality and texture.⁸ Each sheet contained twenty-eight letters, all of the same face and of the same case,—the complete alphabet, with two of its letters repeated. The letters were arranged in random sequence, in four lines; they were so spaced that each letter stood at a distance of 3.7 cm. from its nearest neighbors on the same and on adjacent lines. Fifty-two different sheets of letters were investigated, representing the following twenty-six faces of type, both lower case and upper case. All of our letters were of the size which is technically described as ten-point; the reader will find them illustrated in Tables I and II. (See inserts between pages 8 and 9.)

American Typewriter
Bold Antique
Bulfinch
Caslon Oldstyle No. 540
Century Oldstyle
Century Oldstyle, Bold
Century Expanded
Cheltenham Oldstyle
Cheltenham Bold

⁸ This paper is technically described by the manufacturers as a white, coated book-paper, 25 x 30—80.

Cheltenham Bold, Condensed
 Cheltenham Italic
 Cheltenham Wide
 Clearface
 Clearface Bold
 Clearface Italic
 Clearface Bold Italic
 Cushing No. 2
 Cushing Oldstyle No. 2
 Cushing Monotone
 Della Robbia
 DeVenne No. 2
 DeVenne No. 2, Italic
 Franklin Gothic
 Jenson Oldstyle No. 2
 News Gothic
 Ronaldson Oldstyle No. 551

b. Method of Procedure

All of the readings were made in a semi-darkened room, in order that the (artificial) illumination upon the sheet of letters might be controlled and kept constant throughout. The experimental procedure was as follows: After the observer had become adapted to the illumination of the room, a sheet of letters was placed in position in the carriage and the series of readings began with the carriage at the farther end of the bench. The observer had been instructed to read the letters at a uniform tempo, substituting "blank" for the name of any letter which was not easily decipherable. This precaution seemed necessary to prevent the observer from giving an undue amount of attention to any one letter of the series at the expense of the other letters, i. e., to prevent him from puzzling longer over one member of the series than over any other member. After he had thus attempted to read through the complete list of letters, the carriage was moved to a point twenty centimeters nearer his eye than the initial setting; and he made a second attempt to read the letters. In the first and alternate readings of each series he began at the upper left-hand corner of the sheet and proceeded from left to right along each line, taking the lines, in order, from the top downward. In the second and alternate readings, he began at the lower right-hand corner of the sheet and proceeded from right to left, and from below upwards. This procedure was continued, the carriage being advanced step by step, until every letter upon the sheet had been identified. The experimenter was provided with

a duplicate sheet of letters, similar to the one which had been inserted in the carriage; and upon this duplicate sheet she recorded the misreadings, and the farthest distance at which each letter was read.

Each of the fifty-two sheets of letters was read twice by each of the six observers. Before being inserted in the carriage for its second reading, each sheet was cut along its longitudinal and its transverse diameters; and the four quarter-sheets were reassembled in such fashion that those letters which had formerly appeared upon the marginal regions of the original sheet now appeared upon central regions of the reconstructed sheet, and *vice versa*. A period of several days always elapsed between the first and the second reading of any sheet.

c. Observers

The observers were instructors or students in the department: Messrs. R. Acher, J. W. Baird, E. O. Finkenbinder, F. A. Lombard, H. B. Moyle, and C. W. St. John; they all possessed emmetropic or adequately corrected vision. Each observer gave a complete series of one hundred and four readings.

B. GROUPED LETTERS

In the second group of experiments the apparatus and the method remained unchanged, but here the letters were presented in groups instead of singly. In these later experiments only lower case letters were employed. Eight faces were elected from the twenty-six which had already been used, and Scotch Roman was added,—the complete list of nine faces being as follows:

- Bulfinch
- Caslon Oldstyle No. 540
- Century Oldstyle
- Century Expanded
- Cheltenham Wide
- Cushing Oldstyle No. 2
- Cushing Monotone
- News Gothic
- Scotch Roman

Each group of letters formed a nonsense combination; and the groups of each face were arranged in three lines upon sheets of the same size as had been employed in the former experiments. Sets of grouped letters were printed, in duplicate, upon coated book paper, of the same quality

SHOWING

American
Types

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Our mode of grouping the letters aimed to introduce as many difficult and confusing combinations of letters as possible. We were guided in the combining of the letters into groups by data furnished by Mr. L. D. Evans, an expert proofreader, and by the confusions which had been recorded in our earlier experiments. The combinations of letters which are here appended illustrate a typical series of groups; they also illustrate the Scotch Roman face.

**ksitugy cdzxpbj ftoceygqa wrvlindh
hknurfkxzqg munimm bhwvjyst oceo
vwxarlizxp ybhdonactilsf dnuqqcetrj**

Only three observers, Messrs. Baird, Finkenbinder and St. John, took part in these experiments. Each observer gave two readings of each face,—an average of twenty-four readings of each letter of each face.

d. Results

A. ISOLATED LETTERS

The experimenter's record-sheet contained a statement of the distance at which each letter was read, together with a list of the confusions or misreadings, and an introspective description of the procedure which the observer had followed in deciphering the letters. The numerical data have been compiled and tabulated in various ways.

Tables I and II show the averages of the numerical results, arranged in order of faces. These two tables report the data for 'ordinary' faces only,—the italic, the bold and the condensed faces not being included here. The numbers which appear in these tables indicate the averages of the extreme distances at which the letters were read,—hence the larger the number appended to any letter, the greater the legibility of that letter. Thus, in the first column of Table I, "H 190, I 230" may be taken to signify that the upper case I of the American Typewriter face is considerably more legible than the upper case H of the same face.

Each vertical column of these two tables contains, therefore, a statement of our findings regarding the relative legibility of the various letters of a given face; and the number at the foot of the column indicates the average legibility of the twenty-six letters of that face. The numbers in each horizontal line of the tables indicate the relative legibility

of each of the sixteen variants of each of the twenty-six letter forms.

Table III presents the grand averages of the sixteen faces; it also contains similar data for the bold and for the italic faces and for two extra-bold faces, Franklin Gothic and Bold Antique; while Table IV shows the grand average distance at which each letter of the alphabet was read, the data being here compiled from the readings of the complete set of sixteen faces.

The effect of certain definite modifications of a given letter-form is shown in Tables V and VI. These two tables are compiled from results which were obtained with Cheltenham Old-style presented in ordinary, in bold, in bold-condensed, (in wide,) and in italicized form.

Tables VII, VIII, IX, and X show the five variants of each letter which proved to be most legible, and the five which proved to be least legible.

B. GROUPED LETTERS

The results of our second series of experiments are presented in Tables XI and XII. Table XI shows the average distance at which each letter of each of the nine faces was read when presented in groups. The reader is warned against drawing any conclusion from this table regarding the relative legibility of the various letters of any given face, e.g., regarding the relative legibility of the Caslon m and the Caslon, or any other, k. In other words, the numbers which appear in the horizontal lines are comparable with one another; but the numbers which appear in the vertical columns are incomparable with one another. Table XII presents the same results as are contained in Table XI, but they are now arranged in order of magnitude in order to show the (descending) order of legibility of the several variants of each letter-form.

IV. DISCUSSION OF RESULTS

A. ISOLATED LETTERS

The problem with which we are here concerned may be given the following general formulation: Which of several geometrical figures is most clearly perceptible, and most readily distinguishable from other geometrical figures? But while the twenty-six letter-forms which constitute the alphabet may be regarded as a series of geometrical figures of different shapes and of different degrees of complexity of detail, and while any twenty-five of the different twenty-six

SHOWING THE

American Typewriter	
a	184.2
b	208.3
c	168.3
d	230
e	162.5
f	241.7
g	203.3
h	207.5
i	206.7
j	256.7
k	188.3
l	230
m	195
n	195.8
o	188.3
p	238.3
q	233.3
r	210.8
s	149.2
t	198.3
u	198.3
v	195
w	183.3
x	180.8
y	230
z	159

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TABLE III. ISOLATED LETTERS
A COMPARISON OF THE AVERAGE LEGIBILITY OF VARIOUS
FACES. ORDER OF LEGIBILITY

UPPER CASE		Lower Case	
<i>The Sixteen Roman Faces</i>			
JENSON	281.7	News Gothic	236.4
BULFINCH	273.8	Bulfinch	233.6
CHELT. W.	268.5	Clearface	229.5
CENTURY O. S.	270.4	Century O. S.	228.0
CLEARFACE	269.3	Century Exp.	226.7
CHELT. O. S.	268.5	Chelt. W.	224.3
DELLA ROBBIA	266.8	Jenson	214.7
NEWS GOTHIC	264.6	Della Robbia	214.2
CENTURY EXP.	264.8	Cushing O. S.	212.6
CASLON O. S.	250.7	Ronaldson	209.2
CUSHING O. S.	247.6	Chelt. O. S.	206.4
DE VINNE NO. 2	243.2	De Vinne No. 2	204.8
RONALDSON	241.7	American Typewr.	201.7
CUSHING MON.	228.4	Caslon O. S.	201.7
CUSHING NO. 2	224.8	Cushing Mon.	190.6
AMERICAN TYPEWR.	196.8	Cushing No. 2	185.6
<i>Average</i>	252.8	<i>Average</i>	213.7
<i>Bold Faces</i>			
CENT. O. S. BOLD	296.0	Cent. O. S. Bold	255.1
CHELT. O. S. BOLD	286.2	Chelt. O. S. Bold	233.4
CLEARFACE BOLD	273.7	Clearface Bold	230.5
<i>Average (Bold)</i>	285.3	<i>Average (Bold)</i>	239.7
<i>Italic Faces</i>			
CLEAR. ITALIC	274.3	Clear. Italic	231.2
CHELT. ITALIC	259.6	Chelt. Italic	203.8
DE VINNE ITALIC	235.5	De Vinne Italic	201.9
<i>Average (Italic)</i>	256.5	<i>Average (Italic)</i>	212.3
<i>Average (of same faces, Roman)</i>	260.3	<i>Average (of same faces, Roman)</i>	213.6
<i>Bold Italic Face</i>			
CLEAR. B. ITALIC	265.4	Clearface B. Italic	213.2
<i>Extra Bold Faces</i>			
BOLD ANT.	307.4	Bold Antique	260.5
FRANK. GOTHIC	284.8	Franklin Gothic	245.2

TABLE IV. ISOLATED LETTERS
 THE RELATIVE LEGIBILITY OF THE LETTERS OF THE
 ALPHABET. (AVERAGE OF SIXTEEN FACES;
 192 READINGS OF EACH LETTER)

UPPER CASE		Lower Case	
W	300.2	m	296.8
M	293.8	w	261.6
L	291.1	d	254.3
J	287.5	j	239.4
I	280.4	l	236.3
A	272.4	p	236.1
T	268.9	f	233.0
C	265.1	q	226.4
V	263.5	y	224.6
Q	261.7	i	224.1
P	257.9	h	222.7
D	254.3	g	220.6
O	254.0	b	217.8
Y	252.1	k	216.9
U	251.3	v	213.1
F	241.6	r	203.6
H	240.5	t	199.6
X	239.8	n	195.7
G	237.6	c	193.8
N	235.5	u	193.1
Z	233.8	o	190.1
K	231.7	x	181.7
E	223.9	a	177.0
R	214.0	e	173.5
B	208.9	z	171.6
S	205.7	s	152.6
<i>Average</i>	252.8	<i>Average</i>	213.8

TABLE V. UPPER CASE
THE EFFECT OF VARIOUS MODIFICATIONS OF A GIVEN FACE
Cheltenham

Ordinary	Bold	Bold Condensed	Wide	Italic
A 291.7	A 303.3	A 190.0	<i>The Upper Case letters of Cheltenham Wide are identical with those of Cheltenham Old Style (First Column of this Table).</i>	A 273.3
B 210.0	B 236.7	B 204.2		B 220.0
C 290.0	C 295.0	C 253.3		C 283.3
D 270.0	D 284.2	D 260.0		D 261.7
E 259.2	E 273.3	E 225.8		E 237.5
F 241.7	F 281.7	F 239.2		F 235.0
G 275.0	G 280.0	G 232.5		G 240.0
H 256.7	H 295.0	H 213.3		H 263.3
I 268.3	I 306.7	I 273.3		I 270.0
J 281.7	J 295.0	J 290.0		J 276.7
K 254.2	K 277.5	K 234.2		K 240.8
L 300.0	L 311.7	L 280.0		L 288.3
M 303.3	M 321.7	M 295.0		M 301.7
N 261.7	N 270.0	N 216.7		N 256.7
O 278.3	O 295.0	O 243.3		O 280.0
P 270.8	P 293.3	P 240.8		P 286.7
Q 291.7	Q 300.0	Q 258.3		Q 286.7
R 255.0	R 253.3	R 205.0		R 244.2
S 215.0	S 228.2	S 187.5		S 206.7
T 271.2	T 306.7	T 271.7		T 258.3
U 266.7	U 298.3	U 240.0		U 263.3
V 288.3	V 305.0	V 254.2		V 240.8
W 306.7	W 323.3	W 300.0		W 278.3
X 263.3	X 270.0	X 255.0		X 242.5
Y 249.2	Y 273.3	Y 256.7		Y 245.0
Z 261.7	Z 263.3	Z 235.0		Z 268.3
Average 268.5	286.2	248.2		259.6

TABLE VI. LOWER CASE
THE EFFECT OF VARIOUS MODIFICATIONS OF A GIVEN FACE
Cheltenham

Ordinary	Bold	Bold Condensed	Wide	Italic
a 155.0	a 195.8	a 167.5	a 190.8	<i>a</i> 159.2
b 221.7	b 221.7	b 209.2	b 245.0	<i>b</i> 195.0
c 180.8	c 198.3	c 185.8	c 200.8	<i>c</i> 192.5
d 261.7	d 285.0	d 275.0	d 276.7	<i>d</i> 263.3
e 169.2	e 185.8	e 170.8	e 185.8	<i>e</i> 165.0
f 235.0	f 244.2	f 214.2	f 241.7	<i>f</i> 261.7
g 195.8	g 222.5	g 202.5	g 216.7	<i>g</i> 216.7
h 211.7	h 251.7	h 238.3	h 238.3	<i>h</i> 241.7
i 235.0	i 226.7	i 206.7	i 251.7	<i>i</i> 251.7
j 234.2	j 280.0	j 246.7	j 248.3	<i>j</i> 222.5
k 211.7	k 225.8	k 244.2	k 224.2	<i>k</i> 217.5
l 240.0	l 270.0	l 231.7	l 254.2	<i>l</i> 230.0
m 295.0	m 301.7	m 273.3	m 315.0	<i>m</i> 273.3
n 181.7	n 217.5	n 175.8	n 208.3	<i>n</i> 198.3
o 181.7	o 192.5	o 160.0	o 189.2	<i>o</i> 169.2
p 223.3	p 255.0	p 225.8	p 247.5	<i>p</i> 223.3
q 221.7	q 255.0	q 205.8	q 219.2	<i>q</i> 196.7
r 187.5	r 223.3	r 199.2	r 214.2	<i>r</i> 205.8
s 138.3	s 140.8	s 135.8	s 160.0	<i>s</i> 131.7
t 183.3	t 222.5	t 208.3	t 190.0	<i>t</i> 192.5
u 177.5	u 217.5	u 170.8	u 197.5	<i>u</i> 179.2
v 205.0	v 263.3	v 208.3	v 223.3	<i>v</i> 158.3
w 263.3	w 300.0	w 261.7	w 293.3	<i>w</i> 245.0
x 169.2	x 190.8	x 185.0	x 184.2	<i>x</i> 174.2
y 222.5	y 245.0	y 224.2	y 236.7	<i>y</i> 174.2
z 164.2	z 175.8	z 154.2	z 179.2	<i>z</i> 160.0
<i>Average</i> 206.4	233.4	205.9	224.3	203.8

TABLE VII. THE FIVE MOST LEGIBLE ALPHABETS. UPPER CASE

THE FIRST COLUMN CONTAINS THE "IDEAL ALPHABET"; OR THE FACES WHICH PROVED TO BE MOST LEGIBLE; THE SECOND COLUMN GIVES THE FACES WHICH RANKED SECOND IN ORDER OF LEGIBILITY, ETC.

A	Century Exp.	300	A	Century O. S.	300	A	Jenson	300	A	Della Robbia	293.3	A	Chelt. O. S.	291.7
B	Bulfinch	231.7	B	News Gothic	230.8	B	Jenson	229.2	B	Clearface	221.7	B	Century O. S.	221.7
C	Jenson	310	C	Bulfinch	293.3	C	Chelt. O. S.	290	C	Clearface	288.8	C	Century O. S.	285
D	Jenson	300	D	Century O. S.	281.7	D	Bulfinch	275	D	Century Exp.	273.3	D	Chelt. O. S.	270
E	Chelt. O. S.	259.2	E	Jenson	245.8	E	Century O. S.	241.7	E	Century Exp.	240.8	E	News Gothic	240
F	Jenson	276.7	F	Clearface	270.7	F	Century Exp.	265.8	F	Century O. S.	265	F	Bulfinch	254.2
G	Bulfinch	276.7	G	Chelt. O. S.	275	G	Jenson	273.3	G	Century O. S.	265	G	Clearface	258.6
H	Della Robbia	283.3	H	Jenson	273.3	H	Bulfinch	266.7	H	Clearface	261.2	H	Chelt. O. S.	256.7
I	Clearface	327.2	I	Della Robbia	301.7	I	Bulfinch	300	I	News Gothic	296.7	I	Jenson	296.7
J	Clearface	323	J	Jenson	320	J	Della Robbia	315	J	Century Exp.	301.7	J	Century O. S.	300
K	Jenson	270	K	Bulfinch	262.5	K	Century O. S.	256.7	K	Chelt. O. S.	254.2	K	De Vinne No. 2	243.3
L	Clearface	315.1	L	Jenson	311.7	L	Century O. S.	308.3	L	Bulfinch	305	L	Century Exp.	301.7
M	Clearface	323	M	Della Robbia	321.8	M	Jenson	318.3	M	Bulfinch	316.7	M	Cushing O. S.	315
N	Jenson	270	N	Chelt. O. S.	261.7	N	Della Robbia	258.3	N	Century O. S.	258.3	N	Clearface	247
O	Jenson	296.7	O	Century O. S.	293.3	O	Bulfinch	293.3	O	Chelt. O. S.	278.3	O	Della Robbia	275
P	Bulfinch	301.7	P	Jenson	296.7	P	Clearface	286	P	Century Exp.	281.7	P	News Gothic	278.3
Q	Bulfinch	308.3	Q	Jenson	295	Q	Chelt. O. S.	291.7	Q	Clearface	285	Q	News Gothic	278.3
R	Chelt. O. S.	255	R	News Gothic	240	R	Century Exp.	235	R	Jenson	234.2	R	Della Robbia	228.3
S	Bulfinch	236.7	S	Century O. S.	225	S	Jenson	223.3	S	News Gothic	216.7	S	Chelt. O. S.	215
T	Jenson	308.3	T	Century O. S.	305	T	Della Robbia	295	T	News Gothic	280.8	T	Cushing O. S.	280
U	Century Exp.	276.7	U	Della Robbia	275	U	News Gothic	273.3	U	Jenson	270.8	U	Clearface	269.1
V	Jenson	310	V	Della Robbia	291.7	V	Chelt. O. S.	288.3	V	Century O. S.	281.7	V	Century Exp.	278.3
W	Della Robbia	343.3	W	Century O. S.	331.7	W	Clearface	318.2	W	Century Exp.	316.7	W	News Gothic	316.7
X	Chelt. O. S.	263.3	X	Bulfinch	260.8	X	Century O. S.	257.5	X	Jenson	256.7	X	Della Robbia	252.5
Y	Century O. S.	271.7	Y	Bulfinch	268.3	Y	Clearface	266	Y	Della Robbia	263.3	Y	Jenson	261.7
Z	Jenson	270	Z	Chelt. O. S.	261.7	Z	Bulfinch	216.7	Z	Della Robbia	256.7	Z	News Gothic	255.8

TABLE VIII. THE FIVE MOST LEGIBLE ALPHABETS. LOWER CASE

THE FIRST COLUMN CONTAINS THE IDEAL ALPHABET; OR THE FACES WHICH PROVED TO BE MOST LEGIBLE;
THE SECOND COLUMN GIVES THE FACES WHICH RANKED SECOND IN ORDER OF LEGIBILITY, ETC.

a	Century O. S.	197.5	a	Century Exp.	196.7	a	Chelt. W.	190.8	a	News Gothic	190	a	Bulfinch	185
b	Century O. S.	245	b	Chelt. W.	245	b	News Gothic	245	b	Della Robbia	223.3	b	Clearface	223
c	Clearface	235.9	c	Century O. S.	230	c	News Gothic	221.7	c	Bulfinch	207.5	c	Chelt. W.	200.8
d	Clearface	283.4	d	Chelt. W.	276.7	d	Della Robbia	276.7	d	Century Exp.	273.3	d	Cushing O. S.	260
e	Century O. S.	197.5	e	Jenson O. S.	191.7	e	News Gothic	191.7	e	Century Exp.	187.5	e	Chelt. W.	185.8
f	News Gothic	263.3	f	Bulfinch	261.7	f	Della Robbia	260	f	Century Exp.	256.7	f	Century O. S.	256.7
g	News Gothic	258.3	g	Bulfinch	251.7	g	Clearface	250	g	Century O. S.	245	g	Century Exp.	241.7
h	Clearface	247	h	Bulfinch	241.7	h	Century Exp.	238.3	h	Chelt. W.	238.3	h	Della Robbia	236.7
i	Chelt. W.	251.7	i	News Gothic	249.2	i	Century O. S.	245	i	Bulfinch	243.3	i	Chelt. O. S.	235
j	Century Exp.	283.3	j	News Gothic	280.8	j	Clearface	264.4	j	Am. Typewr.	256.7	j	Chelt. W.	248.3
k	Bulfinch	236.7	k	Century Exp.	235	k	Jenson O. S.	233.3	k	News Gothic	233.3	k	Chelt. W.	224.3
l	Clearface	280.2	l	Bulfinch	258.7	l	Chelt. W.	254.2	l	Century Exp.	252.5	l	Jenson O. S.	251.7
m	Bulfinch	333.3	m	News Gothic	326.7	m	Clearface	325.1	m	Chelt. W.	315	m	De Vinne No.	2315
n	News Gothic	220	n	Bulfinch	213.3	n	Century O. S.	213.3	n	Clearface	213.7	n	Chelt. W.	208.3
o	Bulfinch	218.3	o	Century Exp.	213.3	o	Century O. S.	211.7	o	News Gothic	207.5	o	Clearface	199.5
p	Bulfinch	271.2	p	Clearface	259.7	p	Jenson O. S.	255	p	News Gothic	248.3	p	Chelt. W.	247.5
q	News Gothic	257.5	q	Century Exp.	250	q	Bulfinch	250	q	Della Robbia	238.3	q	Cushing O. S.	235
r	News Gothic	237.5	r	Century Exp.	226.7	r	Bulfinch	216.7	r	Century O. S.	216.7	r	Clearface	215.4
s	News Gothic	177.5	s	Bulfinch	167.5	s	Century O. S.	167.5	s	Century Exp.	163	s	Chelt. W.	160
t	Bulfinch	230.8	t	Clearface	228	t	News Gothic	223.3	t	Century Exp.	221.7	t	Cushing O. S.	208.3
u	Bulfinch	225	u	News Gothic	215	u	Century O. S.	212.5	u	Clearface	207.4	u	Century Exp.	198.3
v	Bulfinch	240	v	News Gothic	235.8	v	Century O. S.	230	v	Cushing O. S.	225.8	v	Clearface	225.4
w	News Gothic	305	w	Clearface	296	w	Chelt. W.	293.3	w	Cushing O. S.	281.7	w	Della Robbia	280
x	Bulfinch	211.7	x	Century O. S.	200	x	Century Exp.	195	x	News Gothic	193.3	x	Jenson O. S.	192.5
y	News Gothic	246.7	y	Bulfinch	245	y	Jenson O. S.	241.7	y	Clearface	237.5	y	Chelt. W.	236.7
z	News Gothic	197.5	z	Bulfinch	196.7	z	Century O. S.	182.5	z	Chelt. W.	179.2	z	Jenson O. S.	171.7

TABLE IX. THE FIVE LEAST LEGIBLE ALPHABETS. UPPER CASE

THE FIRST COLUMN SHOWS THE LEAST LEGIBLE ALPHABET WHICH COULD BE MADE UP FROM OUR SIXTEEN FACES;
THE SECOND COLUMN SHOWS THE FACES WHICH RANK SECOND IN ORDER OF ILLEGIBILITY, ETC.

A	Am. Typewr.	221.7	A	Cushing Mon.	234.2	A	Cushing No. 2	241.7	A	Cushing O. S.	257.5	A	Ronaldson	263.3
B	Am. Typewr.	176.7	B	Cushing Mon.	179.2	B	Ronaldson	196.7	B	Cushing O. S.	204.2	B	Caslon O. S.	206.7
C	Am. Typewr.	195	C	Cushing No. 2	243.3	C	Cushing Mon.	251.7	C	Cushing O. S.	259.2	C	Ronaldson	259.2
D	Am. Typewr.	183.3	D	Cushing No. 2	218.3	D	Cushing Mon.	236.7	D	Della Robbia	243.3	D	Ronaldson	246.7
E	Cushing Mon.	192.5	E	Am. Typewr.	193.3	E	Cushing O. S.	198.3	E	Ronaldson	208.3	E	Cushing No. 2	209.2
F	Am. Typewr.	191.7	F	Cushing No. 2	208.3	F	Caslon O. S.	210.7	F	Cushing Mon.	217.5	F	Cushing O. S.	234.2
G	Am. Typewr.	169.2	G	De Vinne No. 2	184.2	G	Cushing No. 2	197.5	G	Ronaldson	213.3	G	Cushing Mon.	214.2
H	Am. Typewr.	190	H	Cushing No. 2	202.5	H	Cushing O. S.	213.3	H	Cushing Mon.	214.2	H	De Vinne No. 2	233.3
I	Am. Typewr.	230	I	Cushing No. 2	244.2	I	Cushing Mon.	256.7	I	Chelt. O. S.	268.3	I	Ronaldson	270
J	Am. Typewr.	226.7	J	Cushing Mon.	260	J	De Vinne No. 2	266.7	J	Cushing No. 2	271.2	J	Ronaldson	281.7
K	Am. Typewr.	177.5	K	Cushing Mon.	200	K	Della Robbia	217.5	K	Caslon O. S.	220.8	K	Cushing O. S.	228.3
L	Am. Typewr.	248.3	L	Cushing No. 2	261.7	L	Cushing Mon.	266.7	L	Caslon O. S.	281.7	L	Ronaldson	283.3
M	Am. Typewr.	189.2	M	Ronaldson	268.3	M	Cushing No. 2	273.3	M	Cushing Mon.	275	M	De Vinne No. 2	290
N	Am. Typewr.	184.2	N	Cushing No. 2	201.7	N	Cushing Mon.	215	N	Cushing O. S.	220	N	Ronaldson	225
O	Am. Typewr.	186.7	O	Cushing No. 2	215	O	Cushing Mon.	219.2	O	De Vinne No. 2	226.7	O	Cushing O. S.	230.8
P	Am. Typewr.	190	P	Ronaldson	229.2	P	Cushing Mon.	236.7	P	Cushing No. 2	238.3	P	Caslon O. S.	245
Q	Am. Typewr.	217.5	Q	Cushing No. 2	220	Q	De Vinne No. 2	224.2	Q	Ronaldson	231.7	Q	Cushing Mon.	245
R	Cushing Mon.	180	R	Am. Typewr.	186.7	R	De Vinne No. 2	193.3	R	Cushing No. 2	196.7	R	Cushing O. S.	198.3
S	Am. Typewr.	168.3	S	Cushing No. 2	182.5	S	Cushing Mon.	183.3	S	Caslon O. S.	197.5	S	De Vinne No. 2	200
T	Cushing No. 2	219.2	T	Am. Typewr.	220.8	T	Cushing Mon.	237.5	T	De Vinne No. 2	251.7	T	Ronaldson	251.7
U	Am. Typewr.	200.8	U	Cushing No. 2	220	U	Cushing Mon.	232.5	U	Cushing O. S.	233.3	U	Ronaldson	237.5
V	Am. Typewr.	205	V	Cushing Mon.	236.7	V	Cushing No. 2	237.5	V	Cushing O. S.	246.7	V	De Vinne No. 2	248.3
W	Am. Typewr.	165	W	Cushing Mon.	285	W	Cushing No. 2	288.3	W	Caslon O. S.	291.7	W	Ronaldson	301.7
X	Am. Typewr.	192.5	X	Cushing No. 2	212.5	X	Cushing Mon.	222.5	X	Ronaldson	228.3	X	De Vinne No. 2	236.7
Y	Am. Typewr.	221.7	Y	De Vinne No. 2	225	Y	Cushing No. 2	233.3	Y	Cushing No. 2	241.7	Y	Chelt. O. S.	249.2
Z	Am. Typewr.	187.5	Z	Cushing No. 2	204.2	Z	Cushing Mon.	207.5	Z	Ronaldson	210.7	Z	De Vinne No. 2	216.7

TABLE X. THE FIVE LEAST LEGIBLE ALPHABETS. LOWER CASE

THE FIRST COLUMN SHOWS THE LEAST LEGIBLE ALPHABET WHICH COULD BE MADE UP FROM OUR SIXTEEN FACES;
THE SECOND COLUMN SHOWS THE FACES WHICH RANK SECOND IN ORDER OF ILLEGIBILITY, ETC.

a	Chelt. O. S. 155	Cushing No. 2 155.8 a	Cushing Mon. 155.8 a	Della Robbia 167.5 a	Ronaldson O.S. 169.2
b	Cushing No. 2 171.7 b	Caslon O. S. 190	De Vinne No. 2 195.8 b	Cushing Mon. 203.3 b	Cushing O. S. 206.7
c	Am. Typewr. 168.3 c	Cushing Mon. 171.7 c	Cushing No. 2 174.2 c	Cushing O. S. 179.2 c	Della Robbia 181.7
d	Cushing No. 2 205.8 d	Am. Typewr. 230	Cushing Mon. 233.3 d	Ronaldson O.S. 245 d	Jenson O. S. 246.7
e	Cushing No. 2 140	Cushing Mon. 146.7 e	Am. Typewr. 162.5 e	Cushing O. S. 164.2 e	Ronaldson O.S. 165
f	Cushing Mon. 178.3 f	Cushing No. 2 184.2 f	De Vinne No. 2 205 f	Jenson O. S. 225 f	Caslon O. S. 225
g	Caslon O. S. 182.5 g	De Vinne No. 2 191.7 g	Chelt. O. S. 195.8 g	Ronaldson O.S. 198.3 g	Jenson O. S. 202.5
h	Cushing No. 2 190.8 h	Cushing Mon. 200	De Vinne No. 2 205 h	Am. Typewr. 207.5 h	Caslon O. S. 210.7
i	Cushing No. 2 200	Ronaldson O.S. 204.2 i	Am. Typewr. 206.7 i	Caslon O. S. 209.2 i	De Vinne No. 2 214.2
j	Cushing Mon. 298.3 j	Della Robbia 210.7 j	Jenson O. S. 210 j	Cushing No. 2 218.3 j	Cushing O. S. 227.5
k	Cushing No. 2 183.3 k	Am. Typewr. 188.3 k	Caslon O. S. 197.5 k	Cushing Mon. 200 k	Della Robbia 206.7
l	Cushing Mon. 197.5 l	De Vinne No. 2 190.8 l	Cushing No. 2 208.3 l	Caslon O. S. 219.2 l	News Gothic 221.7
m	Am. Typewr. 195 m	Cushing No. 2 273.3 m	Cushing Mon. 276.7 m	Century Exp. 286.7 m	Caslon O. S. 291.7
n	Cushing No. 2 162.5 n	Cushing Mon. 164.3 n	Cushing O. S. 172.5 n	Chelt. O. S. 181.7 n	Caslon O. S. 190
o	Cushing No. 2 170	De Vinne No. 2 170.8 o	Cushing O. S. 172.5 o	Cushing Mon. 175 o	Ronaldson O.S. 180
p	Cushing Mon. 200.8 p	Cushing No. 2 205 p	Ronaldson O.S. 217.5 p	Caslon O. S. 220.8 p	Chelt. O. S. 223.3
q	Cushing No. 2 196.7 q	Cushing Mon. 206.7 q	De Vinne No. 2 212.5 q	Ronaldson O.S. 217.5 q	Chelt. W. 219.2
r	Cushing No. 2 175.8 r	Ronaldson O.S. 181.7 r	Cushing Mon. 183.3 r	Chelt. O. S. 189.2 r	Della Robbia 190
s	Chelt. O. S. 138.3 s	Della Robbia 138.3 s	Ronaldson O.S. 141.8 s	Caslon O. S. 143.3 s	Cushing No. 2 145.5
t	Cushing No. 2 169.2 t	Cushing Mon. 179.2 t	Caslon O. S. 180.8 t	Chelt. O. S. 183.3 t	Jenson O. S. 188.3
u	Cushing Mon. 165 u	Cushing O. S. 175.8 u	Cushing No. 2 176.7 u	Chelt. O. S. 177.5 u	Jenson O. S. 180
v	Cushing No. 2 183.3 v	Caslon O. S. 180.8 v	Am. Typewr. 195 v	De Vinne No. 2 199.2 v	Chelt. O. S. 205
w	Am. Typewr. 183.3 w	Cushing No. 2 200.8 w	Cushing Mon. 233.3 w	Caslon O. S. 243.3 w	De Vinne No. 2 248.3
x	Cushing Mon. 155 x	Cushing No. 2 157.5 x	Chelt. O. S. 169.2 x	Ronaldson O.S. 170 x	Caslon O. S. 171.7
y	Cushing No. 2 194.2 y	Cushing Mon. 195.8 y	De Vinne No. 2 208.3 y	Ronaldson O.S. 210.7 y	Century Exp. 218.3
z	Cushing Mon. 143.3 z	Cushing No. 2 156.7 z	Cushing O. S. 157.5 z	Am. Typewr. 159.2 z	Caslon O. S. 162.5

TABLE XI. THE AVERAGE LEGIBILITY OF GROUPED LETTERS

THE NUMBERS IN THIS TABLE INDICATE THE AVERAGE DISTANCE AT WHICH EACH LETTER OF EACH FACE WAS READ. NINE FACES WERE SELECTED FOR THIS EXPERIMENT; AND ONLY LOWER CASE LETTERS WERE EMPLOYED. THE AVERAGES ARE COMPILED FROM 'INTERNAL' LETTERS ONLY, I. E., THE INITIAL LETTERS AND THE FINAL LETTERS OF THE GROUPS ARE NOT INCLUDED IN THESE AVERAGES

Bulfinch	Caslon	Century Exp.	Century O. S.	Cheltenham Wide	Cushing Monotone	Cushing O. S.	News Gothic	Scotch Roman
a 140	a 137	a 150	a 145	a 142	a 123	a 139	a 160	a 135
b 138	b 155	b 158	b 155	b 152	b 138	b 146	b 170	b 182
c 147	c 130	c 140	c 143	c 152	c 131	c 142	c 167	c 123
d 142	d 133	d 154	d 150	d 158	d 123	d 140	d 163	d 127
e 124	e 127	e 135	e 145	e 135	e 120	e 138	e 149	e 115
f 160	f 175	f 193	f 178	f 168	f 120	f 150	f 174	f 170
g 185	g 190	g 205	g 200	g 210	g 195	g 213	g 218	g 215
h 163	h 184	h 170	h 160	h 165	h 150	h 172	h 143	h 150
i 143	i 143	i 156	i 168	i 153	i 152	i 167	i 162	i 149
j 140	j 175	j 170	j 180	j 165	j 175	j 187	j 155	j 160
k 183	k 183	k 160	k 185	k 175	k 150	k 195	k 168	k 185
l 136	l 137	l 153	l 162	l 163	l 141	l 147	l 138	l 148
m 148	m 141	m 152	m 144	m 152	m 147	m 165	m 165	m 148
n 136	n 129	n 140	n 145	n 155	n 150	n 145	n 146	n 127
o 143	o 139	o 141	o 155	o 160	o 128	o 138	o 160	o 120
p 158	p 195	p 190	p 168	p 195	p 195	p 220	p 169	p 185
q 150	q 163	q 177	q 190	q 175	q 147	q 173	q 173	q 164
r 146	r 141	r 158	r 165	r 141	r 141	r 157	r 158	r 141
s 165	s 122	s 135	s 152	s 130	s 120	s 133	s 175	s 129
t 136	t 125	t 149	t 158	t 123	t 128	t 173	t 171	t 158
u 153	u 123	u 140	u 145	u 150	u 133	u 153	u 166	u 136
v 153	v 154	v 157	v 153	v 158	v 138	v 153	v 154	v 148
w 188	w 170	w 187	w 195	w 185	w 188	w 203	w 198	w 185
x 166	x 133	x 158	x 161	x 144	x 134	x 158	x 167	x 137
y 153	y 142	y 160	y 162	y 170	y 155	y 195	y 164	y 158
z 163	z 126	z 135	z 149	z 147	z 120	z 130	z 165	z 125
Aver. 150	149	159	162	159	144	163	166	151

TABLE XII. THE RELATIVE LEGIBILITY OF GROUPED LETTERS

THE LETTERS IN EACH HORIZONTAL LINE OF THIS TABLE ARE ARRANGED IN DESCENDING ORDER OF LEGIBILITY—THE VERTICAL COLUMN AT THE LEFT CONTAINING THE MOST LEGIBLE ALPHABET. THE DATA FROM WHICH THIS TABLE WAS COMPILED DID NOT INCLUDE THE INITIAL LETTERS NOR THE FINAL LETTERS OF THE GROUPS

a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d
e	e	e	e	e	e	e	e	e
f	f	f	f	f	f	f	f	f
g	g	g	g	g	g	g	g	g
h	h	h	h	h	h	h	h	h
i	i	i	i	i	i	i	i	i
j	j	j	j	j	j	j	j	j
k	k	k	k	k	k	k	k	k
l	l	l	l	l	l	l	l	l
m	m	m	m	m	m	m	m	m
n	n	n	n	n	n	n	n	n
o	o	o	o	o	o	o	o	o
p	p	p	p	p	p	p	p	p
q	q	q	q	q	q	q	q	q
r	r	r	r	r	r	r	r	r
s	s	s	s	s	s	s	s	s
t	t	t	t	t	t	t	t	t
u	u	u	u	u	u	u	u	u
v	v	v	v	v	v	v	v	v
w	w	w	w	w	w	w	w	w
x	x	x	x	x	x	x	x	x
y	y	y	y	y	y	y	y	y
z	z	z	z	z	z	z	z	z

different faces of type which were employed in the present investigation may be regarded as variants from the twenty-sixth or common letter-form, yet, as a matter of fact, such a simple mode of envisagement of our problem does not do justice to the complex conditions which are found to be present in such a problem as this. The factors of size, of geometrical figure, and of heaviness or lightness of the lines which constitute the figure also play a part; and these two latter factors are neither constant nor uniform in their operation, as the reader may infer from an examination of the faces which are illustrated in Tables I, II, III, V, VI, VII, VIII, IX, X, XI and XII.

It is true that all of the letters employed in the investigation were printed in ten-point size. But the type-founder's unit of measurement refers to the size of the block of metal upon whose base the letter is cast, and not to the size of the letter itself. It is, of course, true that the size of the block of metal sets a limit which the size of the letter cannot exceed; but the size of the letter may be, and usually is, less than the size of the block of metal which supports it and which determines the number of 'points' which shall technically describe the size of the letter. Indeed, it is not unusual to cast, say, an eight-point letter upon a ten-point body; and a much greater difference between size of letter and size of body is possible, although greater divergences are neither customary nor commendable.

Hence, the fact that all of our letters are technically described as being of ten-point size does not guarantee that they shall all be of uniform width, nor even of uniform height. There are certain letters, the w's and the m's, which must, in the very nature of the case, be wider than others, the i's and the l's; and even the widths of the m and the w may vary, from face to face, if only the draughtsmen who design them choose to have it so. Nor are the heights of ten-point letters necessarily constant and uniform. Moreover, the lines which constitute the letter-form are themselves subject to variation; they may be faint, they may be heavy, they may be bold, they may contain both hair-lines and heavy lines, or they may contain lines of only one width or thickness throughout. Hence, any discussion of our results must consider the possible operation of three factors which may have to do with the legibility of letters: letter-form, size of letter, width of lines of letter. And when we come to the discussion of the results obtained from groups of letters, we shall see that yet a fourth factor—the extent of white margin around the letter—plays an important rôle.

A survey of Tables I, II and III shows that, as a matter of fact, all three variables are represented in the letters which were employed. But if, for the moment, we ignore these details, and seek to determine which of these sixteen faces, as actually employed in the art of printing, is the most readily legible when presented singly, we find an exceedingly interesting state of affairs.

Confining our attention first to the upper case letters, we discover that the Jenson face has a considerable lead over all of its competitors. The letters of the Jenson face were read, on the average, at a distance of approximately 282 cm., while the average for the sixteen faces is *ca.* 254 cm. The least legible face is American Typewriter,—which, indeed, is much less legible than any other face of the sixteen. The other fourteen faces fall into three groups. The most legible group contains (besides Jenson) Bulfinch, Century Oldstyle, Clearface, Cheltenham Oldstyle, Della Robbia, Century Expanded, News Gothic; Caslon Oldstyle, Cushing Oldstyle, DeVenne No. 2 and Ronaldson constitute the second group; while Cushing Monotone and Cushing No. 2 come next in order, with American Typewriter standing in a class by itself, as the least legible face.

Jenson was much less successful in designing a legible lower case face; his lower case characters are indeed scarcely more legible than the median of the sixteen faces. News Gothic proved to be the most legible of the lower case faces; and Cushing No. 2 is the least legible face of this series. Here the sixteen faces fall naturally into three groups: 1. News Gothic, Bulfinch, Clearface, Century Oldstyle, Century Expanded and Cheltenham Wide; 2. Jenson, Della Robbia, Cushing Oldstyle, Ronaldson Oldstyle, Cheltenham Oldstyle, DeVenne No. 2, American Typewriter and Caslon Oldstyle; 3. Cushing Monotone and Cushing No. 2. The difference between the least legible face and the most legible face is much less in the lower case letters than in the upper case letters,—twenty-one per cent. as compared with thirty per cent.

The briefest examination of the letters which were employed in our investigation is sufficient to show that they differ not only in their form, but also in their size, and in the thickness or heaviness of the lines which constitute them. In order to obtain a clearer insight into the relative significance of each of these variable factors as determinants of legibility, we made accurate measurements of the height and the width of certain lower case letters of each face, as well as of the breadth of the lines which go to make up the

letters. Our measurements were made by means of a microscope which was equipped with a micrometer scale. Three letters, m, o and z, were selected for measurement; and it is assumed that the average size of these three letters, chosen from any face, may be regarded as being typical or representative of the relative size of all of the letters of the complete alphabet of the face to which they belong. In order to make it possible to institute a comparison between the size and the "blackness" or "heaviness" of any face of type, on the one hand, and its degree of legibility, on the other,

TABLE XIII. ISOLATED LETTERS

SHOWING THE WIDTH AND THE HEIGHT OF LETTER, AND THE THICKNESS OF LINE, EMPLOYED IN THE VARIOUS FACES, AND THEIR RELATION TO LEGIBILITY.

	Wide	High	Thick	h X w	h X w X t	Average distance
1. News Gothic . . .	1933	1982	333	3831	1277	236
2. Bulfinch	2033	1800	328	3659	1200	234
3. Clearface	1840	1750	333	3220	1073	230
4. Century O. S. . . .	1944	1780	300	3460	1038	228
5. Century Exp. . . .	1813	1766	300	3202	961	227
6. Cheltenham W. . .	1833	1420	317	2603	823	224
7. Jenson O. S. . . .	1812	1560	317	2827	896	215
8. Della Robbia. . . .	1757	1602	275	2815	774	214
9. Cushing O. S. . . .	1553	1700	333	2640	880	213
10. Ronaldson O. S. . .	1613	1481	243	2389	580	209
11. Chelt. O. S. . . .	1523	1440	316	2193	693	206
12. DeVinne No. 2. . .	1853	1510	450	2798	1259	205
13. Am. Typwr.	1544	1820	200	2810	562	202
14. Caslon O. S. . . .	1611	1420	292	2288	668	202
15. Cushing Mon. . . .	1471	1464	220	2154	474	191
16. Cushing No. 2. . .	1493	1480	200	2210	442	186

the following table is appended. The first column contains the list of sixteen faces, arranged in order of legibility. The numbers in the second column indicate the average width, expressed in microns, of the m, o and z of the face whose name appears upon the same line in the first column; and the third column specifies the average height of the same three letters. The numbers in the fourth column indicate the thickness of the stem of the i of each face, also expressed in microns. Each number in the fifth column is obtained by multiplying the height of the letter by its width; each of these numbers may be assumed to represent the coefficient

of area of a typical letter of each face. The numbers in the sixth column are obtained by multiplying the number which represents the area-coefficient by the number which represents the breadth of the principal lines which constitute the letter; these numbers in the sixth column may, therefore, be regarded as area-breadth coefficients which represent the relative size of letter and breadth of line which appear in the several faces.⁸ Now an examination of the numbers in the fifth column shows that there is, in the upper part of the column at least, an approximate correlation between size of letter and degree of legibility. And when "heaviness" of line is also taken into consideration, as is done in the sixth column, one finds that the correlation is even more striking, for the first eight faces of the list. The fact that degree of legibility is correlated, at least in this approximate fashion, with size of letter and breadth of line of letter, leads one to suspect that, in these eight faces at least, the size of the letters and the amount of ink imprinted upon the paper by the lines of the letter were the chief determinants of legibility; and that such variants of letter-form as were represented in these eight faces played no essential part in determining the legibility of the letters.

The less legible faces of the list do not show such a perfect correlation. The lack of correlation is most evident in the case of DeVinne No. 2, which apparently should stand near the head of the list if size of letter and breadth of inked lines were the chief determinants of legibility. But it will be noticed that this face contains by far the heaviest lines of the series; and its relative illegibility is probably due to the fact that the optimal width of line is here exceeded, and that, in consequence, the white spaces within the letters have been encroached upon in so great degree as to promote illegibility. It would appear that the optimal breadth of line for lower case letters of this size may be in the neighborhood of 275 to 333 microns. It seems to be evident from our table that, when the breadth is reduced much below 250, or is increased in the neighborhood of 450, ten-point letters become relatively illegible.

• It is scarcely possible, from the data at hand, to make any definite general statement regarding the relative significance of the three factors in question. Javal and others have insisted

⁸ The numbers in the fifth and the sixth columns are intended to represent relative magnitudes only. In order to facilitate comparison we have omitted several of the right-hand digits,—three from the numbers of the fifth column, six from the numbers of the sixth column.

that the width of the letter is of prime significance as a determinant of legibility. And the fact that Cheltenham Wide, lower case, is read at an average distance of two hundred and twenty-four centimeters, while Cheltenham Oldstyle, which differs from the former scarcely at all save in its lesser width, is read only at two hundred and six centimeters, seems to confirm Javal's statement. But our experiments have convinced us that width of letter is but one of several factors which contribute to legibility; and one could assert with quite as much justice that the breadth of the lines which constitute the letter is the essential determinant of legibility. This latter statement, however, is true, if at all, only within relatively narrow limits.

The results which appear in Tables V and VI are of interest in this connection. Our experimental material here consisted of alphabets which represented a series of modifications of a given face. Cheltenham Oldstyle may be regarded as our standard face; Cheltenham Bold, Cheltenham Bold-Condensed, Cheltenham Wide and Cheltenham Italic represent modifications of our standard letter-form in the directions of greater heaviness of face, lesser width of letter-form, greater width of letter-form, and inclined or italic letter-form.

A survey of these results reveals the fact that legibility is very much increased by increased heaviness of face. In the upper case letters the increase in heaviness or breadth of line amounted to approximately forty-seven per cent., and the increase in legibility amounted to twelve per cent.; while in the lower case letters the corresponding data are forty-seven and fourteen per cent. When the Cheltenham Bold face is condensed by about twenty-three per cent., as is illustrated in the letters which appear in the third column of Table VI, its increase of legibility is lost,—being reduced by twelve per cent. This finding indicates that whatever advantage might have been derivable from increased heaviness of face, as compared with Cheltenham Oldstyle, is neutralized by a disadvantage which is due to a narrowing of the internal spaces within the letters, and a consequent sacrifice of detail. When the letter-form is broadened, by eighteen per cent., its legibility is increased by nine per cent. The Italic letter-form proves to be but slightly less legible than the Roman face. In both the upper case and the lower case letters, the bold face is the most legible member of the series of modifications.

The data which are presented in Table IV show the relative legibility of each letter of the alphabet, both upper case

and lower case, when presented as isolated letters. The numbers which appear in these columns represent the averages of the readings of the sixteen faces of each letter. The upper case letters are, of course, legible at a greater average distance from the observer than the lower case letters. But the average legibility of both cases varies between wide limits; and it is a significant fact that certain of the latter letters are more legible than many of the former. The progressive decrease of legibility from the upper limit to the lower limit is fairly regular and uniform throughout, in both cases, with the exception of m and s. Indeed, our results show that the lower case s is by far the least legible letter of either alphabet. The upper case S also stands at the foot of its class, but the relative inferiority is here much less than in the lower case letter.

Any movement which plans to improve the forms of the letters of the alphabet must properly begin with the letters which appear in the lower half of this table. And, indeed, it might well confine itself, at the outset at least, to the lower case letters, for the twofold reason that they are, in general, less legible than upper case letters and are therefore most in need of reformation, and that our reading has to do, in the main, with the recognition of words which are composed of lower case letters exclusively. It is not the purpose of this paper to recommend or even to suggest the procedure by means of which an increased legibility of printing types is to be attained. But it may, at least, be mentioned in passing that letters are made more legible by an increased heaviness of printing-face; and that defective letters may be made more legible by simply extending their width. Both of these innovations would meet with opposition, however, from those readers who demand aesthetic beauty and grace of form as well as legibility. But it seems possible that all demands could be met and all interests could be safe-guarded if only sufficient skill and ingenuity were devoted to the task.

B. GROUPED LETTERS

The object of this part of the investigation was to determine how and to what extent the legibility of letters is affected by the presence of adjacent letters. It was to be expected that the isolated letter should possess an advantage over the member of the letter-group in point of average distance at which reading is possible. Is the disadvantage which results from grouping equally great for each face? What is the relation between legibility and position (initial, final,

intermediate) within the group of letters? What light is thrown upon our problem by the number and the nature of the misreadings or confusions which are due to the grouping of letters?

Isolated letters are invariably read at a greater average distance than are those letters which occur in groups. Among our material were eight faces which had been employed in both of our series of experiments, *i. e.*, they had been presented singly in the earlier experiments,—grouped in the later experiments. It is therefore possible to make a direct comparison between the degrees of legibility which were revealed under these two conditions. (The Scotch Roman face can not be included in making this comparison, because it was employed only in the later series of experiments.) The average distance at which these eight faces were read in the earlier experiments was 232 cm.; in the later experiments, 157 cm. The varying degrees of legibility tend to be reduced to a common level as a result of grouping, *i. e.*, differences in the legibility of different faces tend now to disappear. While the legibility of the eight faces, presented as single letters, varied between the limits 191 cm. and 236 cm., they varied only between the limits 144 cm. and 166 cm. when presented in groups. And the general reduction of legibility was so great that the most legible face of grouped letters proved to be wholly undecipherable at a distance where the least legible face of isolated letters was clearly and unmistakably legible.

The gross results of the experiments with grouped letters are presented in Table XI. The average distances are tabulated in more significant form in Table XIII, which also contains a statement of the relation between decreased legibility and size-heaviness of face.

News Gothic is still the most legible face, and Cushing Monotone the least legible. Century Oldstyle, Century Expanded, Cheltenham Wide and Caslon also maintain the same positions in the series which they held when isolated letters were employed. But Cushing Oldstyle, which occupied the sixth position in the former series, now moves up to the second position; and Bulfinch drops from the second to the sixth position. Scotch Roman, the face which had not been tested in the first part of the investigation, stands seventh in descending order of legibility.

Cushing Oldstyle and Bulfinch are the only faces which show any decided loss or gain in relative legibility, when submitted to the group-test. But one is led to inquire why

even these two faces should fail to maintain the same degree of relative legibility when presented in groups which they established when presented as isolated letters.

A comparison of the amounts of reduction in legibility which the various faces suffered from being grouped reveals the fact that these amounts vary from twenty-three per cent. to thirty-seven per cent. It is inevitable that certain faces should be subject to a relatively great disadvantage as a result of being combined into groups, and from being printed "solid," as upon the body of an unleaded page. The letters of certain faces are so wide and so high that a comparatively narrow margin is left upon the block of metal which constitutes the body of the type, while in other faces the margin is relatively wide. For example, our measurements show that the Bulfinch m is 2560 microns in width and 1828 microns in height, while the corresponding measurements of the Cheltenham Oldstyle m are 1948 and 1440 microns. Variations in width of letter need not be considered here, because there need be no corresponding variations of width of blank space between adjoining letters upon the printed page. But the difference in height between the letters of these two faces is so great that adjacent lines of the two, if set "solid," would show an intervening space of white paper which would be 380 microns wider in the case of Cheltenham than in the case of Bulfinch. It follows then that while the ten-point letters of greatest average height are most legible when presented singly,—because they subtend a larger visual angle,—they tend to lose their advantage when combined into groups and lines,—because the lines are separated from one another by narrower intervening spaces of white; and the reader finds that the letters of adjoining lines tend to merge into one another.

The effect of breadth of interlinear space could be shown quantitatively by correlating the average height of each face with the relative amount of decrease in legibility which it suffers as a result of grouping. It would then be found that those faces whose average height is greatest have suffered most from being presented in groups, while those faces whose average height is least have suffered least. The correlation becomes more striking however when thickness of line as well as height of letter is taken into account. But even here, News Gothic and Cushing Old Style appear to be exceptions to the general rule.

Now it is a remarkable fact that these two types are by far the heaviest faces of the series. In selecting an arbitrary method of giving quantitative expression to the combined

influence of the factors of size of letter and of heaviness of line, in order that seriation and comparison might thereby be facilitated, we have chosen to multiply the height of the letter by the thickness of the line. It is evident, however, that these two factors are wholly different in their mode of operation and in their relation to legibility. The legibility of a face undoubtedly increases directly with the increase in the size of the face; and the ratio between the two is capable of simple quantitative expression. But the relation between legibility and heaviness of face is far from being a simple one. Beginning with the faintest monotone, legibility increases with increase of thickness of line until an optimal thickness of line, for a given size of letter, is reached; from that point onward legibility decreases with increase of thickness of line, because now the internal details of a, c, e, o, etc., are being narrowed down to mere points, and discrimination of detail soon ceases to be possible. We are not in possession of any data which furnish a basis for estimating the point at which the optimal thickness of line is reached, nor for estimating the relative significance of size of letter and thickness of line. And until such data are obtained it will remain impossible to seriate the numbers in the fifth column in any just or appropriate fashion.

Our results, however, indicate that the variations of letter-form which were present in our nine faces did not vary between sufficiently wide limits to have any considerable effect upon the relative legibility of our letters. Such differences of legibility as were revealed are, we believe, referable solely to variations in size of letter (and of interlinear space), and to variations in heaviness of face.

If legibility is to be our sole criterion of excellence of type-face, News Gothic must be regarded as our nearest approximation to an ideal face, in so far as the present investigation is able to decide this question. The aesthetic factor must always be taken into account, however, here as elsewhere. And the reader who prefers the appearance of Cushing Oldstyle or a Century face may gratify his aesthetic demands without any considerable sacrifice of legibility.

An examination of our records of the misreadings of letters throws an interesting light upon the question of similarities of letter-form, and upon the question of the criteria employed by the reader in deciphering letters. When the letters first appeared at or beyond the extreme limit of reading distance, the reader was usually conscious, from the outset, of a more or less definite *Einstellung*. If they were lower case letters,

and especially if they were presented in isolated form, the reader first set out upon a more or less definite search for the "broad" letters,—m and w. He seldom failed to discover these two letters in the earlier stages of the settings of the carriage, although he was seldom able to discriminate between m and w until the carriage had been brought nearer to his eye. His next endeavor was to find the "narrow" letters,—i, l, j; another category was "letters which are wider at the top than at the bottom,"—v, r; V, Y, T, F, P. Here again he almost invariably succeeded in referring the letter-form to its appropriate category some little time before he was able to distinguish its details and name it with any degree of certainty. Other general groups were "circular letters,"—o, e, c; O, C, G, Q; "square letters,"—H, K, E, B, D. Among the lower case letters, "ascenders" and "descenders" were almost invariably recognized as such, before their details became clear. While the reader was still struggling with one or other of these categories, the "unclassified" letter-form began to emerge in an order which can not well be formulated in a general statement.

This description of the reader's procedure indicates the type of confusion or misreading which proved to be most frequent. Letters which may be regarded as members of a common category were especially likely to be confused with one another; r, v; o, c, e; x, z; u, n; b, h, k; q, y; i, l, j, t, f; M, W; H, K, E, B, D; O, Q, C, G; V, Y F T; I J, L.

Several wholly new types of misreadings made their appearance when the letters were presented in groups. These may be described as 1. Combinations, 2. Separations, and 3. Elisions. 1. It frequently happened that adjoining letters were blended together by the reader, and that a single letter was constituted by this combination of parts, or wholes, of different letters, thus: lc (k); ls (k); lx (k); li (h); cl (d); cf (d); un (m); in (m); vr (w); js (p); vj (y); cj (q); hj (ly); bj (lq); chn (dm); ck (dx). 2. The separation of letters into their parts has been illustrated in the above group. It also occurred in such cases as wm (vun); ld (bl); bj (lq); hj (ly); kd (hcl). 3. perhaps the most striking misreading was due to the complete elision of certain letters of the group. This phenomenon was especially common with such slender or narrow letters as i, j, t, r, v, s. When i or t was interpolated between ascending letters, when j occurred between descenders, and when r and s were present in any context of whatever sort, they were likely to be wholly overlooked. And it frequently happened in such cases that

the observer read and reread the group of letters, specifying correctly every letter which was present excepting these narrow letters. When the carriage had been brought so close to his eye that he finally detected their presence, he usually expressed surprise that these "indifferent" letters had escaped detection so long.

The position of the letter in the group—initial, final, intermediate—is an important factor in determining the legibility of the letter. When a group of letters first comes into view, it almost invariably happens that certain of the letters stand out more prominently than their neighbors. The part which these "dominating" letters play in our recognition of familiar words has been discussed at length by Zeitler, Messmer, and others, who have pointed out that the rôle of the "indifferent" letters in our recognition of familiar words is relatively insignificant. Pillsbury and others have shown that, all other conditions being equal, the initial letter or letters in the word are of most significance in the act of reading.

In compiling the results obtained from the reading of our letter-groups, we have made three distinct tables of data,—for the initial letters, for the final letters and for the intermediate letters of the groups. The letter results have already been presented, in Tables XI and XII. A comparison of these three series of average distances shows that the initial position constitutes an optimal condition of legibility; the final position comes next in order, and the intermediate position is least favorable,—the general averages being 196 cm., 185 cm., and 156 c., respectively.

It must, of course, be borne in mind that all intermediate positions are not equally disadvantageous, because the form of the adjacent letters is really an essential factor which aids or hinders legibility. For instance, an *m* which stands between *u* and *n* is much less legible than an *m* which stands between *o* and *c*; and the helpful or harmful influence of ascending and descending letters is also very great. The significance of the initial position or the final position is also subject to variation. It is evident, for instance, that those letters whose "loop" is upon the right,—*b*, *h*, *p*,—will derive more benefit from appearing in the final position than will those letters whose "loop" is upon the left,—*d*, *q*. Yet the superior advantage of the initial position is so great that *b*, *h*, and *p* frequently proved to be read at a greater distance when they appeared as initials than when they appeared as final letters, notwithstanding the fact that the characteristic parts of these letters appeared in close proximity to a

neighbor in the former case, while in the latter case they juttet out into the blank spaces between the groups.

Lower case c was read at the following average distances: Initial 155 cm., final 163 cm., intermediate 144 cm. The corresponding data for several other letters are: e, 140, 147, 123; o, 158, 153, 143; b, 187, 198, 155; d, 200, 165, 143; h, 185, 200, 162; k, 195, 198, 176; p, 201, 207, 186; q, 209, 194, 168; f, 196, 202, 176. The "symmetrical" letters show, in more accurate quantitative form, the relative advantages of the initial and the final positions; v, 185, 172, 152; o, 158, 153, 143; m, 163, 156, 151; w, 210, 199, 189.¹

THE RELATION BETWEEN LEGIBILITY AND QUALITY OF PAPER-SURFACE

As already indicated, our groups of letters were printed in duplicate upon a coated book-paper, and upon an antique laid book-paper. A comparison of the average distances at which the letters were read under these two conditions should throw light upon the general question as to the dependence of legibility upon the quality and texture of paper employed by the printer.

This question has been raised in various forms, in the history of the art of printing. Many years ago Babbage recommended the use of slightly yellowish paper for the manufacture of books; and indeed, he succeeded in persuading a publisher to produce a book of logarithms in accordance with this recommendation. More recently Javal has advocated a similar innovation, urging that such a plan would minimize the disadvantage to which the reader is subjected on account of the intensive contrast between the black ink and the white paper which are in general use.

It is impossible, from data available in the literature of this

¹The reader is again warned that these data do not warrant a comparison as to the relative legibility of different letters of the alphabet. The writer does not guarantee that the juxtapositions of letters which occurred in our groups were equally disadvantageous for all of the letters of the groups. It is obviously an exceedingly difficult task to so arrange a series of groupings that all of the letters in the groups will be treated with even-handed justice in so far as advantageous and disadvantageous collocation with their neighbors is concerned. A juxtaposition which is relatively advantageous to l or h may be relatively disadvantageous to o or v. This condition we could not hope to fulfil; our aim was rather to treat all of the faces with equal fairness,—to present no combination of letters of one face which did not recur in the letters of every other face; our data therefore warrant a comparison of the relative legibility of the various faces, but not of the relative legibility of the various individual letters of the same or different faces.

and cognate topics, to determine whether this Babbage-Javal suggestion is really of value. But such results of the present investigation as have a bearing upon the question would seem to indicate that little or no improvement of legibility is to be expected from progress in this direction.

The results which we obtained in those experiments which consisted in presenting groups of letters of nine faces which had been printed upon coated white paper and rough-finished, very slightly yellowish paper, show a surprisingly slight difference of legibility in the two cases. The average distance at which the letters were read in the former case was 144.9 cm., and in the latter case, 145.0 cm. Altogether 234 letters were employed in these experiments, and 2,808 readings were taken. The experimental conditions were identical in the two cases, excepting the difference in the quality, the color and the texture of the paper upon which the letters were printed. Occasionally we found individual differences among our observers,—a greater efficiency when a particular face of type appeared upon the one or other of the papers; but in not a single instance does the individual difference in legibility amount to more than three per cent.; and in no instance did we find a unanimous preference of either paper with any face of type. Not only then are the individual variations so slight as to be negligible, but they are so irregular and inconstant as to be subsumable under no general principle. And the only conclusion which they warrant is that even such a considerable difference as was represented in our two papers has little or no significance for legibility.

V. CONCLUSIONS

1. Certain faces of type are much more legible than other faces; and certain letters of every face are much more legible than other letters of the same face.
2. These differences in legibility prove to be greater when letters are presented in isolation from one another than when they are presented in groups.
3. Legibility is a product of six factors: 1. the form of the letter; 2. the size of the letter; 3. the heaviness of the face of the letter (the thickness of the lines which constitute the letter); 4. the width of the white margin which surrounds the letter; 5. the position of the letter in the letter-group; 6. the shape and size of the adjacent letters. In our experiments, the first factor seemed to be less significant than any of the other five, *i.e.*, in the type-faces which were employed in the present investigation, the form of any given letter of the alphabet usually

varied between such narrow limits as to constitute a relatively insignificant factor in the determination of its legibility.

4. The relatively heavy-faced types prove to be more legible than the light-faced types. The optimal heaviness of face seems to lie in a mean between the bold faces and such light faces as Scotch Roman and Cushing Monotone.
5. The initial position in a group of letters is the most advantageous position for legibility; the final position comes next in order of advantage, and the intermediate or internal positions are least favorable for legibility.
6. The size and the form of the letters which stand adjacent to any given letter play an important rôle in determining its legibility; and the misreadings which occur in the case of grouped letters are of a wholly different sort from those which occur in the case of isolated letters. When letters of the same height or of similar form appear side by side, they become relatively illegible. But the juxtaposition of an ascender, a descender and a short letter tends to improve the legibility of each, as also does the juxtaposition of letters which are made up wholly or chiefly of straight lines and letters which are made up wholly or chiefly of curved lines.
7. The quality and the texture of the paper is a much less significant factor than has been supposed,—provided, of course, that the illumination and the inclination of the paper are such as to secure an optimal condition of light reflection from its surface.
8. There is an urgent need for modification of certain letters of the alphabet.

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THE PSYCHOLOGY OF THE NEW *BRITANNICA*

By E. B. TITCHENER

The psychological centre of the new *Britannica* is the comprehensive article by Professor Ward, which has now, we may suppose, taken on its final form. The article was first written for the ninth edition,¹ and appeared in 1886. It was written, therefore, at the age when, as its author reminds us, a man has already become 'a bundle of habits'; there was nothing tentative about it, no suggestion of the rough draught of a system; every topic had its appointed place, and every argument showed mature reflection. It was written also, Professor Ward tells me, under some pressure of time; and this circumstance had its good effect; the essay is *aus Einem Gusse gegossen*. Recognition came at once: the late Professor Bain, who had been warmly praised and soundly pummelled, replies in the same knightly fashion: "the thorough knowledge of previous works, the freshness of the handling, the never-failing acuteness, the light thrown upon many of the dark places of mental science,—constitute the work a signal achievement of philosophical ability."² And the influence of the 'Psychology' has steadily widened; one might, indeed, in a venturesome mood, bring it into comparison with Brentano's *Psychologie vom empirischen Standpunkte*; for the relation which Professor Ward sustains to current British associationism is not unlike that of Brentano to the Wundtian school in Germany.

A second article, prepared for the supplement which took the place of the tenth edition of the *Britannica*, appeared in 1902. The intervening years were notable in the history of psychology; they were years of rapid horizontal expansion, during which laboratories were equipped, journals were founded, and comparative psychology and mental pathology made unwonted progress. It may well be the case that psychology outgrew its strength, that a 'thorough scrutiny of methods' is needed before the new results 'can be safely or

¹The author had already published *A General Analysis of Mind* (Journal of Speculative Philosophy, XVI. 1882, 366), *Objects and their Interaction* (*ibid.* XVII. 1883, 169), and the first two articles entitled *Psychological Principles* (Mind, O. S. VIII. 1883, 153, 465).

²Mr. James Ward's "Psychology," Mind, O. S. XI. 1886, 457.

systematically incorporated into the science:' at any rate there is good material mixed with the bad, sound with the flimsy: and the superficial extension of psychology, the widespread adoption of the psychological attitude, is itself a sociological phenomenon of the first importance. Professor Ward is, however, less interested in these things than in the 'signs of life' shown by the 'old' psychology. He had himself discussed, in the *Naturalism and Agnosticism* of 1899, the great questions of the perception of an external world and of the relation of body and mind. He had also published in 1893-4^{*} two articles on *Assimilation and Association*, in which Höffding's 'quality of familiarity' and 'tied ideas' were turned to account for a genetic study of ideation. James' apologetic paper on the 'Physical Basis of Emotion' came out in 1894; von Ehrenfels' *Gestaltqualitäten* appeared as 'forms of combination' in Stout's *Analytic Psychology* (1896). It is still the 'old' psychology, then, that the supplementary article expounds and advances; the sections on the Experimental Investigation of Memory and on Comparative Psychology are as nearly perfunctory as the writer's critical acumen and philosophical conscience will allow. And so we are not surprised—though many of us, no doubt, have been disappointed—to find that the revised article of 1911 is, in all essentials, simply a skilful blend of the articles of 1886 and 1902.

The supplementary article occupies 17 pages; the original article required 49. The article of 1911 occupies 58 of the slightly larger pages of the new *Britannica*.

The Introduction (§ 1, The Science of "Mind;" § 2, Standpoint of Psychology) is substantially the same as in the article of 1886. Here, as throughout,—the statement may be made once for all,—the author has revised with extreme care; everywhere there is weeding, pruning, dovetailing; but the substance of the two preliminary sections is unchanged. Under *General Analysis* we have first, in § 3, the discussion of Experience from the tenth edition: the paragraph on Pragmatism is omitted. Sections 4-8 then practically repeat the ninth edition; the fine-print discussions of the subjectivity of sensations, of the connection between subjective attention and objective intensity, and of the non-presentability of feeling and attention are, however, omitted. A new § 9 is devoted to *Attention*.^{*} The *Theory of Presentations* opens (§§ 10-12) with the familiar treatment of the Psychological Individual, the Presentation Continuum, and Retentiveness; an interpolated § 13 gives a brief note on Assimilation; and the discussion of Relativity follows (§14), thus changing places with that of Subconsciousness. Professor Ward has entirely rewritten this latter section, §15, and has raised it—if not, as Bain counselled, from brevier to pica, at least—from brevier to long primer: the core of

^{*} Mind, N. S. II. 1893, 347; III. 1894, 509. The tenth and eleventh editions give the dates as 1894-5. The proof-reading of the latter edition is far from impeccable.

^{*} Cf. *Psychological Principles*, III. Mind, O. S. XII. 1887, 45.

doctrine remains unchanged.⁶ Section 16, *Sensation, Movement and the External World*, owes its change of title, its introduction, and its conclusion, to the tenth edition; the treatment of the characteristics of sensation is expanded from the ninth. *Perception* (§§ 17-20) and *Imagination or Ideation* (§§ 21, 22) stand with a few omissions—compensated, as most of the omissions of the article are, by later additions—as they stood before. A new § 23, on the *Genesis and Development of Ideation*, comes in from the tenth edition. Sections 24, 25, *Mental Association and the Memory-Continuum*, and §§ 26-29, *Reminiscence and Expectation: Temporal Perception*, repeat the ninth edition; a critical note is added on the relation of successive to simultaneous association, and on the notions of 'form' and 'law' of association. Then comes the excursus (from the tenth edition) on *Experimental Investigations concerning Memory and Association*. The sections on *Feeling* (§§ 31-33) are as they were. *Emotion and Emotional Expression*, from the tenth edition, follows as § 34; *Emotional and Conative Action*, § 35, stands unaltered. The treatment of *Intellection and Categories* is extended by the introduction of § 39, *Objects of Higher Order: their Analysis and Genesis*, from the tenth edition; otherwise there is practically no change in §§ 36-42. *Belief* is then given a separate heading, and raised to the dignity of long primer. The subject-matter of *Presentation of Self, Self-Consciousness and Conduct* (§§ 44-46) has been newly articulated, and the concluding note on Freedom has been rewritten. Section 47, *Relation of Body and Mind*, comes from the tenth edition, as does also the appendix, § 48, on *Comparative Psychology*. A revised list of *Authorities* brings the article to an end.

"Systematic psychology," Professor Ward has remarked, "is neither bulky nor liable to change every half-dozen years;" and again, "The concepts of general psychology are presupposed in the many special departments, . . . and will be presupposed in whatever new developments of the science the future may have in store." These statements may be taken as the text of his new 'Psychology.' From the point of view of systematic psychology, the only important additions are to be found in the introductory §§ 3, 9, 16 (Experience, Attention, Definition of Sensation), and in §§ 23, 39, which deal with assimilation and form of combination; and in these sections we have simply a clarification and direct extension of the doctrine of 1886. As for the remaining new matter,—while we are all grateful for anything that Professor Ward cares to write,—I cannot but think that from his own standpoint it is irrelevant, and that from the standpoint of the 'special department' it is incomplete. Let me quote, to begin with, a passage from the Editorial Introduction to this eleventh edition of the *Encyclopaedia*. "Those earlier contributions have been preserved," we read, "which are of the nature of classics in the world of letters. By a selective process, which, it is believed, gives new value to the old material

⁶ Cf. *The Present Problems of General Psychology*, Philos. Review, XIII. 1904, 619.

—by the revision, at the hands of their own authors or of later authorities, of such articles or portions of articles as were found to fit accurately into their several places—or by *the inclusion under other headings of a consideration of controverted questions on which the writers may have taken a strong personal view, itself of historical interest*—their retention has been effected so as to conform to the ideal of making the work as a whole representative of the best thought of a later day.”⁶ Admirable!—but, so far as psychology goes, more honored in the breach than in the observance. Professor Ward takes a strong personal view of psychology, which has much more than an historical interest; all psychologists are his debtors for its expression. But he treats of Experimental Psychology in an excursus, and of Comparative Psychology in an appendix to his article; and the specialist looks in vain for the special articles *Experimental Psychology* and *Comparative Psychology*. Those students of psychology—and, rightly or wrongly, there are many of them—who care less for epistemological principles than for the actual *facies* of the science, will hardly agree that the Editor has fulfilled his promise. Again, even if an enlightened view of the Relation of Body and Mind ‘makes psychological revision inevitable,’ still the topic itself belongs, on Professor Ward’s own showing, to Psychophysics,—of which more in a moment; while he would be the last to deny either that the issues in this problem are controverted or that his handling of it is strongly personal.⁷ There remains the discussion of the James-Lange theory of emotion (§ 34). This, if retained in full, should have been incorporated in a special article *Emotion*: there is, by the way, no such article: as it stands, it interrupts the general argument; the reader is jerked to an unfamiliar standpoint.

I turn back once more to the Editorial Introduction,—to the section that deals with formal arrangement. “Under the name of the common subject of the science as a whole,”⁸

⁶Cf. I. xiv. The italics are mine.

⁷Readers of Professor Ward’s recent writings will remember his insistence on the distinction between ‘psychological’ and ‘psychophysical,’ and on the priority of general psychology to ‘physiological psychology.’ Yet in the new article ‘Psychology’ (p. 583), as in the old (p. 69), it is ‘on the whole a satisfactory explanation’ of the pleasurable and painfulness of combinations of colors that “the one arrangement secures and the other prevents perfect retinal activity!”

⁸Will it be objected that psychology is not a ‘science’? But Professor Ward gives as its formal definition ‘the science of mind;’ and the Editorial Introduction makes but one, quite casual, reference to Philosophy. See also Note 12 below.

its history and general aspects are discussed, but the details concerned with the separate scientific questions which fall within its subject-matter . . . are relegated to distinct articles, to the headings of which the general account becomes, if required, a key or pointer. This arrangement of the scientific material—a general article acting as pointer to subsidiary articles, and the latter relieving the general account of details which would overload it—has been adopted throughout the Eleventh Edition; and in the result it is believed that a more complete and at the same time more authoritative survey has been attained, within the limits possible to such a work, than ever before.”⁹ In other words, the present edition follows the ‘dictionary plan,’ whereas the ninth edition followed the ‘single-treatise plan’ of an Encyclopaedia. We shall, therefore, expect to find three groups of subsidiary articles: (1) those which cover the ‘special departments’ of psychology,—experimental psychology, psychology of the abnormal, and so forth; (2) topical articles, corresponding to the chapter-heads of a systematic psychology (sensation, attention, association) and to the more important subdivisions of lines of departmental knowledge (hypnotism, psychology of adolescence); and (3) biographical articles. Let us see what, under these three headings, the twenty-eight volumes have to offer.

(1) I have said that there is no article *Experimental Psychology*; neither is there a *Physiological Psychology*. *Psychophysics*—which in the ninth edition curtly enjoins the reader to ‘see Weber’s Law’—now heads an article; but the article has only 20 lines (about half as many as are assigned to *Teacaddy*); it opens with a false etymology, mentions a few leading names, and ends with a random string of instruments and fields of investigation. This treatment (or lack of treatment) is the more regrettable, since many of the topical articles refer in somewhat sweeping terms to ‘modern physiological psychology’ and to ‘psychophysical researches.’¹⁰ I have said, again, that there is no article *Comparative Psychology*; neither are there articles *Class Psychology*, *Collective Psychology*, *Ethnic Psychology*, *Genetic Psychology*, *Individual or Differential Psychology*, *Psychopathology*, *Social Psychology*. The seeker after knowledge must go either to the topical articles (the range of which will appear in what follows), or to articles written from the standpoint of anthropology, ethnology, phil-

⁹ Cf. I. xviii.

¹⁰ So, e. g., *Affection*, *Association of Ideas*, *Attention*, *Extension*, *Introspection*, etc. Other articles, in which we might expect an experimental reference are silent in the matter: so *Cold*, *Perception*, *Rhythm*, *Space and Time*, etc.

osophy, sociology—of some discipline that is emphatically not psychology, however closely 'related' to it in a classification of the sciences.¹¹ Psychology, indeed, seems to have shown but faintly above the editorial horizon; the fundamental articles on *Evolution* and *Science* ignore it.¹² There is no attempt at a *History of Psychology*, though both *Ethics* and *Logic* receive historical treatment.

There is no article *Applied Psychology*; and there are no articles *Educational Psychology*, *Juristic Psychology* (psychology of testimony, case analysis), *Psychotherapeutics*. There is an elaborate article *Phrenology*¹³ (A. M.);¹⁴ and the expression of emotion is treated under *Physiognomy* (A. M.).

It is obviously far more difficult to say what an Encyclopaedia contains than to point out what titles it omits. And the difficulty is increased, in the present instance, by the lack of an Index. I understand that the forthcoming Index Volume will supply a full page-index of names and subjects. This will doubtless convict me of many mistakes: I do not think, however, that it will make the following notes superfluous.

Psychotherapeutics.—There is nothing to the point in the articles *Medicine* and *Therapeutics*. The article *Hysteria* (J. B. T.; E. B.) says nothing of psychoanalysis. *Christian Science* mentions the recent development of psychotherapy; and *Faith Healing* (N. W. T.) refers all forms of mind-cure (on which there is no article) to suggestion. The articles on *Hypnotism* and *Suggestion* will occupy us later.

Juristic Psychology.—The articles *Attestation*, *Evidence*, *Oath* and *Witness* make no psychological reference. The article *Criminology* (A. G.) refers briefly to the psychology of the criminal.

Educational Psychology.—The article *Child* remarks: "Into the psychological characteristics and development of the child and all the interesting educational problems involved it is impossible to enter here;" the writer accordingly contents himself with a list of books and a word of general caution. The article *Education* (J. We.) makes a bare reference to the psychological differences between Froebel and Herbart. *Habit* is merely defined; *Fatigue* does not appear. I have found nothing on the subject of *Mental Tests*. The article *Interest* is not psychological. Nor—to pass to another department of applied psychology—is the article *Advertisement*.

¹¹ The article *Classification* makes mention of a 'Carl Wundt,' whom I take to be a portmanteau-person, compounded of Carl Stumpf and Wilhelm Wundt.

¹² On the other hand, the article *Philosophy* accepts the "definitive establishment of psychology as an independent science," in order to mark it off sharply from epistemology.

¹³ The subject is also discussed under *Brain*. Several articles upon anatomical and physiological subjects (lists are given under *Anatomy* and *Physiology*), as well as the article *Neuropathology*, are of interest to psychologists.

¹⁴ The initials given here and in later references to psychological articles are those of the authors; the names will be found in the Appendix to this review. Many articles are unsigned.

Genetic Psychology next suggests itself. *Adolescence* is treated from the standpoints of hygiene and education: *Children's Games*, *Infancy*, *Infant*, are not psychological articles; *Play* tantalises us by a reference back to *Child*. We may add here a mention of the brief discussion of *Imitation*:¹⁵ which in turn leads us to the topic of *Instinct* (C. L. M.) This is made a matter exclusively of animal psychology; at least, there is no account of human instincts. The author of the articles writes also upon *Intelligence in Animals*.¹⁶

Social and *Ethnic Psychology* are almost wholly merged in *Anthropology*, with the result that ethnic psychology has the better of the bargain. There are brief remarks on psychology at the beginning and end of the article *Sociology* (B. K.). There is no psychological discussion of *Custom*. The first part of the article *Philology* ('The Science of Language in General,' W. D. W.) is largely psychological. The article *Religion* (J. E. C.; R. R. M.) declares that the origin of religion must be sought conjecturally through psychology, and has a section entitled 'Psychology of the Primitive Attitude towards the Sacred': otherwise there is no explicit discussion of the religious consciousness. The article *Conversion* does not supply this deficiency. *Animism* (N. W. T.) has a section upon the origin of religion; and a long series of related articles—beginning with *Anthropology* (E. B. T.) itself—contain materials for ethnic psychology. I have probably not noted them all; I mention *Costume*, *Death*, *Divination*, *Family*, *Fetichism*, *Folklore*, *Funeral Rites*, *Image Worship*, *Magic*, *Mythology*, *Prayer*, *Ritual*, *Sacrifice*, *Salutations*, *Totemism*. These articles are for the most part of a high order of merit; the psychologist can only regret that the psychological aspect of their subject-matter does not receive greater emphasis, and that they are not more closely articulated with *Psychology*. The article *Aesthetics* (J. S.) is written by a psychologist and from the psychological point of view; and a good deal is said of the psychology of art, social as well as ethnic, in the article *Fine Arts* (S. C.). *Humour* is not treated psychologically; *Wit* has no article.

Collective Psychology finds incidental mention in the articles *Economics*, *Imitation*, *Religion* and *Suggestion*. *Differential Psychology*, whether of the class or of the individual, has been strangely neglected; in particular, there seems to be no discussion anywhere of the psychology of sex; the article *Sex* is purely biological, the article *Prostitution* (save for its brief introduction) purely sociological. *Visualisation* does not appear; and the articles *Galton*, *Image*, *Imagination* are silent regarding it.

There remain *Psychology of the Abnormal* and *Psychopathology*. The article *Dream* (N. W. T.) is of a general, somewhat popular sort; no attempt has been made to correlate it with *Psychology*, and Freud is mentioned only in the bibliography. *Hypnotism* (W. McD.) is treated sympathetically and at length. I should demur to the statement: "As a method of psychological investigation hypnotism has proved . . . capable of throwing much light on the con-

¹⁵ Imitation is also discussed under *Fine Arts* and *Philology*; *Play* under *Aesthetics* and *Fine Arts*.

¹⁶ The article *Heredity* is biological; the word 'psychological' occurs only in a list of transmitted characters. *Mendelism* and *Variation and Selection* are also biological. The latter article speaks of biometrics and of correlation, which have no special articles. For methods of calculating correlation we are referred to an *Error*, *Law of*, which is not included in the eleventh edition. We are also referred to *Probability* (F. Y. E.), which contains a great deal that is of value to the psychologist. *Statistics* is of psychological interest only as it deals with certain elementary points of method.

stitution of the mind, has opened up a number of problems of the deepest interest, and has done more than any other of the many branches of modern psychology to show the limitations and comparative barrenness of the old psychology that relied on introspection alone and figured as a department of general philosophy." The last clause, at any rate, exalts unduly the importance of the hypnotic method and underrates the value of pre-experimental psychology. The section on Theory strikes me as inadequate: as does also, from the psychological side, the same writer's article *Suggestion*. He gives a very full account of *Hallucination*.—The article *Dissociation* is not psychological. The article *Sleep* (J. G. M.) is reprinted without change from the ninth edition: one is glad to read again the classical description of the onset of sleep. The unsigned article *Somnambulism* is by the same author, reprinted from the earlier article *Sleep*. The brief articles *Catalepsy* and *Ecstasy* repeat, with some omissions, the previous articles of the same title; *Fascination* is new.

The article *Aphasia* (J. B. T.) has been rewritten, and gives a sufficient introduction to the subject, which is also discussed under *Brain*. *Medicine* makes a brief reference to morbid psychology. The articles *Hysteria*, *Insanity*" (J. B. T.; J. M.; L. C. B.), etc., are conceived, very naturally, from the standpoint of the psychiatrist rather than from that of the psychologist. There is, of course, psychology in them; but it is not worth while to consider them here in detail.

On the other hand, this is perhaps as good a place as any in which to call attention to the articles—many of them long and elaborate—devoted to *Psychical Research* (A. L.). I have noted *Apparitions* (A. L.), *Automatic Writing* (F. P.), *Clairvoyance* (N. W. T.), *Crystal Gazing* (A. L.), *Hauntings* (A. L.), *Medium* (N. W. T.), *Poltergeist* (A. L.), *Premonition* (F. P.), *Retrocognition* (F. P.), *Second Sight* (A. L.), *Spiritualism* (E. M. S.), *Subliminal Self* (W. McD.)—an article devoted wholly to Myers, *Telepathy* (N. W. T.). *Psychical Research* also figures, more or less largely, in the articles *Automatism* (N. W. T.), *Divination*, *Dream*, *Hallucination*, *Hypnotism*, *Possession* (N. W. T.), *Trance* (W. McD.). Would that the British Psychological Society had urged its claims upon encyclopaedic space as effectively as the Society for Psychical Research!

Are there not, however, other general articles, subsidiary to the 'key' article *Psychology*? There is an article *Naturalism* (J. W.), which deals in part with psychological theory; it is brief, polemical, and enjoins us to 'See also *Psychology*.' There is an unsigned three-sentence article *Parallelism*, *Psychophysical*: it ends, 'See *Psychology*.' There is a short unsigned article *Presentationism*, mainly concerned with Professor Ward's views: 'See especially the article *Psychology*.' There is a still shorter note on *Sensationalism*:

"In the course of correspondence regarding the eleventh edition, Dr. L. N. Wilson called my attention to the fact that Vol. XIV. of the set in the Clark Library repeats the *Insanity* statistics of the ninth edition, although the date assigned is 1901. I find, by personal examination and by further correspondence, that some sets have the correct, others the incorrect figures. (On p. 600 the Total of the first line of the table should be 48,882; if it is 29,452 the statistics of 1871 have been repeated.) Plainly, the plates have been changed since the *Encyclopaedia* was issued. I have made inquiry at the New York office of the Cambridge University Press, but have so far received no reply.

'See *Psychology*.' The reader may turn also, as he is directed, to *Empiricism* and *Phenomenon*: he will find cold comfort. There is no article *Interaction*.

There is an article *Matter*, but there is no article *Mind*, although a critical and historical account of what is, by the definition of the 'key' article, the subject-matter of psychology would have been most welcome. There is an article *Life*, but no article *Consciousness*, although again a critical and historical essay on "the vaguest, most protean and most treacherous of psychological terms" would surely have been in place. I find no articles *Experience*, *Explanation*, though these are suggested by the contents of the central article. *Causation* is too broadly treated to serve psychological purposes; and the note on *Teleology* does not refer to psychology at all.

There is no article on *Scientific Method*. The brief note on *Introspection* is certainly inadequate; it is also, I think, misleading.

There are no articles *Experiment*, *Laboratory*. I have found hardly anything upon psychological apparatus: I recall only the article *Stereoscope* (C. P.),¹⁸ and the cut of Sieveking's aesthesiometer under *Touch*. A page of specifically psychological instruments would not, however, have been space wasted. No reference is made to *Scientific Congresses*. The article *Periodicals* does not mention, under the heading United States, any psychological journal.

(2) I have already trespassed somewhat upon this second division, of topical articles. Coming now to the main body of such articles, I note first a short article *Faculty*.¹⁹ There are no articles *Mental Process*, *Psychosis*.

Sensation does not receive collective treatment. The six main articles, *Vision*, *Hearing*, *Touch*, *Taste*, *Smell* and *Equilibrium* are contributed by Professor J. G. McKendrick. One could not expect the veteran physiologist to plough afresh the immensely extended field of sense-psychology; neither could one desire to see the articles of the new edition taken altogether out of his hands. It is, however, a thousand pities that his work was not gone over by an experimental psychologist of the younger generation. The articles *Vision* and *Hearing*, in particular, are a lamentable blot upon the scholarship of the Encyclopaedia.

¹⁸ This article itself (which bears somewhat too obvious marks of translation from the German) is written from the physical point of view, though it includes psychological discussion. Other physical articles (*Chronograph*, *Photometry*, etc.) may be useful to the psychologist. The article *Phonograph* figures a number of vowel curves.

¹⁹ Mental faculties are also discussed under *Brain*.

In dealing with the departmental articles I have not referred to the tenth edition. It is now necessary to say that the six main articles on sensation are, like the central article *Psychology*, reproduced in essentials from the ninth and tenth editions together. I have no objection whatever to the inclusion of the older results; it is well to be reminded of things that, in the hurry of current research, one is too ready to forget. But the blend of old and new, in these articles, leads too often to muddle, even to contradiction. Here are two statements from *Smell*: (1) "If the two nostrils are filled with different odorous substances there is no mixture of the odors, but we smell sometimes the one and sometimes the other;" (2) "If, by means of a tube, an odor is conveyed into one nostril, while an odor of a different kind is directed into the other, there may be either a compound sensational effect, a sort of double-odor, or one odor may so predominate as entirely to destroy the other. The fusion of odors is not complete, and it is similar to the effect of combining, say, blue and red, in stereoscopic vision." The first of these statements, from Valentin, occurs in the ninth edition; the second appears in the tenth. If, now, we are curious enough to turn to the treatment of binocular color-mixture under *Vision*, we find this: (3) "Blue light may be admitted by the one eye-piece and red by the other; and on the convergence of the two, a resultant color, purple, will be observed. This may be termed the binocular vision of colors. It is remarkable that by a mental effort this sensation of a compound color may be decomposed into its constituents, so that one eye will again see blue and the other red" (from the ninth edition). Comment seems unnecessary.

Turn to *Taste*. (1) "Careful observations have shown that taste is only experienced when the sapid substance is allowed to come into contact with the taste-body, and that the sense is absent or much weakened in those areas of mucous membrane where these [*sic*] are deficient;" (2) "Further experiments with capillary tubes show that fungiform papillae destitute of taste buds, and areas of the surface of the tongue having neither papillae nor taste buds, may still, when stimulated by sapid substances, give rise to tastes;" the ninth and tenth editions again refuse to blend. Once more: (1) "Rapidly interrupted induced currents, which produce little or no electrolysis, may also excite taste" (tenth); (2) "The action of the interrupted current on the terminal organ is analogous to the action of sweet or bitter substances" (tenth); (3) "Rapidly interrupted currents fail to excite the sense" (from Grünhagen, in ninth). The three statements last quoted appear on the same page.

Turn to *Touch*. (1) "Pain is not a sensation excited by irritating the end organs either of touch or of temperature, nor even by irritating directly the filaments of a sensory nerve" (tenth); (2) "This sensation [pain] cannot be supposed to be excited by irritations of the end organs of touch, or of specific thermal end organs (if there be such), but rather to [*sic*] irritation of ordinary sensory nerves" (ninth).—I cannot devote more space to these articles. The essay on *Equilibrium* (new in the tenth edition) is fairly satisfactory;²⁰

²⁰ One passage, at any rate, calls for comment. "A bird, on the other hand [as compared with the human acrobat], depends largely on visual impressions, and it knows by experience that if launched into the air from a height it can fly. Here, probably, is an explanation of the large size of the eyes of birds." (1) The fact that the bird's eye is relatively larger than our own, or than that of mammals generally, might depend upon the difference of type between the structures; the avian eye cannot be thus directly equated to the mammalian. (2) Are the eyes of birds—

the articles *Smell*, *Taste*, *Touch* are unsatisfactory; *Touch*, especially, is confusedly written.

I have to justify, so far as space permits, my criticism of *Hearing*: here, then, are a few points. (1) The *tensor* is credited with a twofold function: it serves as mechanism of accommodation to pitch and it acts as a safety-appliance for intensity. Thus are rival theories reconciled,—though how the muscle discharges its double duty we are, of course, not told. I need not say that recent work has put the accommodation-theory out of court. (2) The vestibular organs are “organs connected with the perception of sounds as sounds, without reference to pitch or quality.” “These structures, however, are concerned rather in the sense of the perception of equilibrium than of sound.” (3) The *DL* of pitch is given as “one sixty-fourth of a semitone,” and again as “one-thousandth of the total number of vibrations,”—without any reference to pitch-number. (4) “When we listen to beats of considerable intensity, produced by two adjacent tones of sufficiently high pitch, the ear may follow as many as 132 intermissions per second.” “Beyond 132 per second, the individual impulses are blended into one uniform auditory sensation.” There is, however, a region of roughness or harshness, between sheer intermission and uniform blending; and Helmholtz’ limit of 132 has been revised by later observers. (5) R. König’s experiments with high forks are said to have ‘settled the question’ of beat tones: that is, the work of Schaefer and Abraham (1901) is ignored. (6) Consonance and dissonance are explained by Helmholtz’ theory of beats, Stumpf is not mentioned in the article. The usual confusion of the two editions shows in the sentence: “Hitherto we have considered only the audition of a single sound, but it is possible also to have simultaneous auditive sensations, as in musical harmony:” two sections earlier there is a discussion of Dissonance (concord and discord).^a (7) The following statement is amazing. “It is possible by means of beats to measure the sensitiveness of the ear by determining the smallest difference in pitch that may give rise to a beat. In no part of the scale can a difference smaller than 0.2 vibration per second be distinguished. The sensitiveness varies with pitch. Thus at 120 vibs. per second, 0.4 vib. per second, at 500 about 0.3 vib. per second, and at 1000, 0.5 vib. per second can be distinguished. This is a remarkable illustration of the sensitiveness of the ear.” It is, unless I have read the sentences wrongheadedly, a remarkable illustration of misunderstanding

that is, of course, the eyeballs—relatively larger than those of mammals? In many cases, obviously; but I doubt the generalisation. There is also a patent difference in size between the eyes of nocturnal and of diurnal birds. (3) The ‘here’ of the last sentence is equivocal; it seems, however, to refer to both of the preceding clauses, to dependence on visual impression and to knowledge of ability to fly. But birds learn to fly, though they may learn quickly; and can we say, in any proper sense, that the adult bird ‘knows’ that it can fly? (4) Do dependence on visual impressions and empirical knowledge of power of flight ‘explain’ the size of the visual organ? It would seem rather that structure and function of the organs of flight, and structure and function of the organs of vision, are all determined interdependently by conditions which it is the business of the biologist to ascertain in detail.

^a In the article *Voice* (J. G. M.) there is a new section, entitled “Vowel Tones.” The author is concerned with the alternative of relative *vs.* fixed pitch of the characteristic partials, and decides by a compromise. This preoccupation forbids any clear statement of the Hermann-Pipping controversy: not, indeed, that the author is unique in that regard, for a sort of fatality of confusion seems to attach to the topic. But, at all events, the reader of the article will get no notion of the difference between the fixed-pitch theories of Helmholtz and Hermann; he may even be led to suppose that Fourier analysis reveals inharmonic partials.

on the part of the author. I take him to say that the *DL* in question are obtained from simultaneously sounding tones, and that they represent the differences of pitch-number at which a beat first becomes audible. To distinguish 1 beat in 5 seconds, even 1 beat in 2 seconds, thus testifies to the ear's sensitivity: and yet we know that the ear can recognize 1 beat in three minutes! This precious bit of tonal psychology has been taken over, uncorrected, from the tenth edition.

It is, I think, needless to go further; if these things lie on the surface, we shall not be likely to find improvement by digging deeper into the article. I therefore pass to *Vision*. (1) There is, first, a blunder in the interpretation of Newton's color-triangle; the ordinates of points within the triangle are taken, not as levers with masses attached, but as representations of amounts of color. (2) The negative after-image is ascribed, roundly, to fatigue. We are, therefore, ready for the statement: "The Young-Helmholtz theory explains the appearance of the consecutive colored images." We are not prepared for the later statement: "Hering's theory accounts satisfactorily for the formation of colored after-images." In point of fact, Hering's theory is incompatible with the doctrine of fatigue; and the negative after-image is precisely one of the facts of vision that Helmholtz fails to explain. (3) "The yellow spot in the centre of the retina is the most sensitive to light . . . Towards the anterior margin of the retina sensitiveness to light becomes diminished." These statements may be taken as true for light adaptation, though it is to be remembered that accurate observations have been made only with colored lights. The statements are, on the other hand, patently untrue as regards dark adaptation. The phenomena of adaptation are not mentioned in the article." (3) "An impression lasts on the retina from 1/50 to 1/30 of a second." If a general statement is permissible, it would be more nearly true to say 1/70 to 1/10 of a second. (4) "Red appears to a red-blind person as a dark green or greenish yellow, yellow and orange as dirty green:" it is odd to read such a statement in the year of grace 1911! (5) "Aubert has stated that the minimum intensity [of light required to excite the retina] is about 300 times less than that of the full moon." He has: but later observers have pointed out that he considerably underestimated the intensity of moonlight; and his determinations have, at the best, no general validity. (6) A diagram is offered for the study of the blind spot, and the reader is instructed to "move the book towards and away from the eye." The dimensions of the diagram are such that, as a rough calculation shows, the 'round spot' disappears at a distance of some four inches from the eye. "The blind spot . . . is sufficiently large to cause a human figure to disappear at a distance of two metres." Helmholtz said *face*. (7) Hering's explanation of contrast is not mentioned; the references are to Helmholtz and Plateau. (8) Nothing is said of the functions of the rods, of twilight vision, of the *Du-plizitätstheorie*. (9) The theory of visual space perception differs from that given in the central article (to which no reference is made); the treatment of illusion is meagre (there is no article *Illusion*); the brief note on apparent solidity does not refer to the article *Stereoscope*. For that matter, no one of these six articles is provided with a bibliography.

²² The special articles treat *Adaptation* from the literary and biological points of view, and *Accommodation* only as a theological term.

There is, in the article *Vision*, a cross-reference to *Color* (J. R. C.). And the reader is plunged at once into a pleasing confusion. "Every color," says J. G. M., "has three qualities: (1) *hue* or tint, such as red, green, violet; (2) *degree of saturation*, or purity, according to the amount of white mixed with the tint, as when we recognise a red or green as pale or deep; and (3) *intensity*, or luminosity, or brightness, as when we designate the tint of a red rose as dark or bright." "Colors," says J. R. C., "differ in three respects, which Maxwell calls *hue*, *shade*, and *tint*. All hues can be produced by combining every pair of primaries in every proportion. The addition of white alters the tint without affecting the hue. If the color be darkened by adding black or by diminishing the illumination, a variation in shade is produced." Physiologist and physicist are thus perplexingly at odds; and neither has troubled to consult the psychologist. The article *Color* remarks, further: "Helmholtz has shown that the only pair of simple spectral colors capable of compounding to white are a greenish-yellow and a blue." When, and where? Helmholtz' complete table has persisted through the three editions of the *Optik*, and is reproduced by J. G. M. under *Vision*!

There are no articles *Kinaesthetic Sensation*, *Organic Sensation*; and the article *Joints* recognises articular sensation only in cases of injury or disease. *Muscular Sense* has a fine-print paragraph under *Touch*. We find a short, colorless article *Hunger and Thirst*, and a special article *Pain*,—although pain has been discussed twice over under *Touch*. There, however, nothing is said of pain spots; and, indeed, the article *Pain* agrees as little with J. G. M. as he, at his different dates, agrees with himself.—

It is, by the way, unfortunate that the cross-references in the psychological articles have not been more carefully scrutinised. Thus, the article *Pain* refers us to *Psychology*, *Aesthetics*, *Nervous System*, *Sympathetic System*. The reference to *Psychology* is correct: we read there of pleasure-pain, of organic pains, of cutaneous pain spots. But nothing about pain will be found under *Aesthetics* (except the passing statement that aesthetic enjoyment is free from certain 'painful elements'); nothing under *Nervous System*; nothing under *Sympathetic System*. The proper references are to *Affection* and *Touch*, neither of which is mentioned: *Brain* might have been added. The article *Attention* refers us to *Psychology*, *Brain*: but the latter article is discreetly silent on the subject²⁸. Many similar instances might be brought forward. On the other hand, there are cases in which a systematic use of cross-references by the editorial staff would have shown omission or divergence in the handling of a topic. The article *Recept*, which gives Romanes' definition of the term, does not refer to other articles. We turn, naturally, to *Intelligence in Animals*; but in that we find nothing save percept and concept. And if we then turn to *Psychology* (p. 561), we find a suggested meaning of reception and recept that ignores both Romanes and the *Recept* article.—

Turning now from quality to intensity of sensation, we find under *Threshold* a bare definition of the intensive stimulus-limen: there are no cross-references. The article *Weber's Law* (A. S. P.-P.) is practically unchanged from the ninth edition. Weber is credited with researches into aural sensations; right and wrong cases still figures as "the method of correct and incorrect instances;" in taste

²⁸ The word 'attention' occurs, it is true, in the account of certain experiments upon the auditory region of the cortex in dogs; but that is all; no attempt is made to determine the 'cortical substrate' or 'mechanism' of attention.

and smell, experiments are still "almost impossible." The author tells us to see *Psychophysics*: which we gladly do: but what is there under *Psychophysics* to see? The article *Extension* is fuller than is usual with articles of its class; but it, like the rest, falls back on the central *Psychology*. There is no article *Duration* or *Protensity*.

After sensation, *Affection*.²⁴ The affective element is recognised as co-ordinate with the sensory. The reference to Wundt's theory is misleading, since on that theory a sensation has always more than one specific affective quality; however, the writer does not repeat the mistake of the *Psychology*, and credit Wundt with the view that affection is a 'property' of sensation. The method of expression is inadequately handled. Fechner is not the writer of a 'modern text-book of psychology.'—There are no articles *Feeling*, *Emotion*, *Expression*; the expression of emotion is, as I have said, discussed under *Physiognomy*. *Mood*, *Passion*, are just defined; *Pleasure* refers us to *Psychology*, and not to *Aesthetics*, *Affection*. *Laughter* is not a psychological article.

A brief systematic article *Attention* is based on that of the ninth edition; it refers us to *Psychology*. There is not a word of description of experimental work. A new article *Apperception* notes briefly the use of the term by Leibniz, Kant, Herbart, and refers to *Attention*, *Psychology*. The reader of the article *Psychology* must be content, so far as this topic is concerned, to go away hungry: the reference itself is aggravatingly characteristic: for these secondary articles, instead of furnishing the details that the 'key' article omits, constantly fall back upon that article for further details. The new article *Conation* makes pleasure-pain a matter of sensation, referring to the experiences as 'hedonic sensations.' There is a false etymology of *algedonics*,—repeated, by the way, and with an additional Greek misspelling, in *Pain*. *Brentano* is called a 'German psychologist,' and is made the author of a *Psychologie*: would that he were! The cross-references are *Attention*, *Psychology*; not *Effort*, for there is no such article; and not *Will*, although there is a long essay with that title.

The short article *Perception* is historical, and bids us see *Psychology*. The special departments of perception fare badly. *Harmony* is written from the musical standpoint; the fusion of pure tones is not considered. *Rhythm* has nothing on perception. I have referred above to the lack of an article *Illusion*. The article *Space and Time* is not psychological. Formally, the perceptions of the various senses (as well as the sensations) are treated in the articles *Vision*, *Hearing*, etc.; the treatment is, however, far from adequate. The article

²⁴ I make no further reference to the tenth edition.

Cinematograph says nothing of theory: all that we have is the remark, under *Vision*, that "The cinematograph owes its effects to persistence of retinal impressions." The articles *Form*, *Fusion* are not psychological.

A new article *Abstraction* is of a general character; a new article *Apprehension* is better, but still not nearly full enough. There is no article *Assimilation*, in spite of the large place which this process occupies in Professor Ward's psychology. The writer of *Association of Ideas* retains the bulk of Croom Robertson's earlier essay;²⁵ and his additions are not particularly happy,—for under 'modern criticism' he refers only to Bradley, and under 'psychophysical researches' to James, Stout, and (misleadingly) to myself. There is no reference either to the modern introspective work or to Jung's association test. *Cognition* has four sentences. All these articles send us to *Psychology: Concept* now breaks the rule, and directs us simply to *Abstraction*; the article is slight. *Idea* supplements the central article by a couple of definitions; *Image* actually quotes from that article; *Imagination* falls distinctly short of it. The anonymous authors seem to have been especially troubled by the centaur: *Idea* tells us that "the idea of a centaur is a complex mental picture composed of the ideas of man and horse;" *Imagination* that "the image of a centaur is the result of combining the common percepts of man and horse." Professor Ward might have remarks to make on both these statements. *Intellect* again informs us of the contents of the general article, to which all the last-mentioned articles refer. The article *Judgment* is not psychological. There is no article *Memory*, though there is a long essay on *Mnemonics* (J. M. M.). There is no article *Thought*; both thought and judgment find passing mention under *Apprehension*.

The article *Action* is not psychological; and *Reaction* appears, so far as I have noticed, only as 'personal equation' in *Personality*.²⁶ There is no *Belief*, though the subject is mentioned under *Apprehension*, *Imagination*. There is a *Desire*:

²⁵ The reviser has crossed out Hartley's acknowledgment of indebtedness to Gay; and, in the article *Hartley*, has dropped a qualifying clause and a sentence which were valuable as giving the reader a just perspective. Condensation is all very well: but the Encyclopaedia contains such choice specimens of verbiage that these special instances of space-hunger are annoying.

²⁶ This article ends with the words: "Machines have been devised which make allowance for the error caused by the personal equation (see *Micrometer*)." The 'make allowance' is puzzling; and I find a reference to the eye and ear method not under *Micrometer* but under *Transit Circle*.—There is, I should add, a mention of association reactions under *Association*.

'for its technical use, see *Psychology*.' For *Gesture* we must turn to *Philology*. *Inhibition* is treated only from the legal standpoint. *Personality* refers us, 'for the psychological problem,' to *Psychology*. *Self* merely says: 'For the psychological use of the term, see *Psychology*, etc.' There is no article *Temperament*. There remains the article *Will*, to which I have already referred. This article (H. H. W.) is entitled *Will, in philosophy*; and we have accordingly no more right to ask it for a volitional psychology than we have to ask the article *Space and Time, in philosophy* for a psychology of perception. It contains, indeed, a section entitled 'Modern psychology,' but this merely discusses the relation of what the writer takes to be modern psychology to the problem of free-will.²⁷ We find, then, no special article upon the psychology of volition. And this is the more to be regretted, as the note on *Motive* interprets the results of "contemporary psychological research" in an unqualified and dogmatic way.

(3) The biographical articles seem to be much better done than the general run of the departmental and topical articles that we have been discussing.²⁸ I notice, however, that the bestowal of the name 'psychologist' is capricious. *Bain* is not called a psychologist, although his "reputation rests upon his psychology." *Baldwin, Bonnet, Fortlage, Fouillée, Höfding, James, Ladd, Lazarus, Lewes*, the two *Mills, Robertson, Romanes, Steinthal, Wundt*,—no one of these men is termed a psychologist; our shelves are filled with the by-products of history, political economy, philosophy, physiology, literary criticism. Not that 'psychologist' is a term of contempt; only

²⁷ In fulfillment of the editorial programme, one might have expected that the article *Determinism* would be put into the hands of some member of the Freudian school, or of someone who knew how to turn the *Aufgabe*-psychology to deterministic account. It is, however, an unsigned and non-committal article.

²⁸ There is still room for criticism, formal and material. Thus the revised bibliography of Adamson's *Beneke* is allowed to retain the statement: "In England, perhaps, the only writer who shows traces of acquaintance with his works is J. D. Morell." True when the article was written, it is not true today. And a question of literary ethics: Should a dead author's initials be appended to an article which has been—even slightly—changed, and whose bibliography contains works published after his death?

On the other hand, the unsigned article *Brown*, which is in all essentials a condensation of the article by Adamson in the ninth edition, omits Adamson's list of Brown's 'positive contributions to mental science.' On this topic Adamson was peculiarly qualified to speak, and the information would have been useful to psychological readers.

its application is casual. *K. G. Carus*²⁹ is psychologist and physiologist, *Huarte* is physician and psychologist, *Mach* is physicist and psychologist (though surely Mach, outside of physics, is an *Erkenntnistheoretiker*), *Münsterberg* is psychophysiologist, *Gurney*, *Ribot*, *Sully* are psychologists, *Waitz* is anthropologist and psychologist, *Ward* is psychologist and metaphysician. How purely casual the distribution is, we see from the article *Fechner*; the founder of psychophysics is termed 'German experimental psychologist.'

Of psychologists living when the text of the Encyclopaedia was prepared, Great Britain has mention of *Sully* and *Ward*; Stout, whose text-books and whose editorship of *Mind* make him, probably, the most influential of living English psychologists, has no article. France has *Fouillée* and *Ribot*,³⁰ Binet, whose untimely death we are now deploring, and Pierre Janet had earned a mention. Germany has *Wundt*, and a half of *Münsterberg*: that is all. Ebbinghaus, Lipps, G. E. Müller, Stumpf,³¹ and on the applied side Meumann and Stern, might have been noticed; the omission of Stumpf is unpardonable. Austria has *Mach*; Brentano and Freud, to say the least, should have found a place. Denmark has *Höfding*. The United States has *Baldwin*, *James*, *Ladd*, and a half of *Münsterberg*. All these deserve mention; but then, indisputably, so does Stanley Hall.

The articles vary in merit. That on *Ward* strikes me as, of its kind, perfect; it tells, in brief compass, just what one wishes to know of its subject. That on *James* is inadequate; that on *Wundt* needs an adjective far stronger than inadequate.³²

²⁹ The initials should be *C. G.* The correction is trivial, as the name in question is *Carl*; but it gives me an opportunity to remark that the initials of the Encyclopaedia—so far as psychology is concerned—are not always trustworthy.

³⁰ I am glad to be able to place Professor Ribot here; the Encyclopaedia dates his death 1903.

³¹ So far as I have observed, Stumpf and the *Tonpsychologie* receive textual mention only in the article *Aesthetics*.

³² There are articles on *Charcot*, *Galton*, *Myers*, *Porter*. It may save some reader trouble if I add that I have looked in vain for *Aubert*, *Delboeuf*, *Drobisch*, *Hering*, *Horwicz*, *Meinong*, *Mosso*, *Pearson*, *Richet*, *Sergi*, *Tetens*, *Volkman*, *E. H. Weber*. There is no attempt at a psychological appraisal of *Crusius*, *Priestley*, *Reimarus*, *J. L. Vives*; the latter's *De anima et vita* is not named. In truth, psychological perspective, whether geographical or temporal, is sadly lacking.

The article *Fechner* gives a brief sketch of Fechner's psychophysical and philosophical system, but refers neither to *Weber's Law* nor to *Metaphysics*. The article *Wundt* mentions Wundt's *System*, but fails to inform the reader that its contents are discussed under *Metaphysics*.

My general impression, after this survey, is that the new *Britannica* does not reproduce the psychological atmosphere of its day and generation. So far as psychology is concerned, the Editor protests a great deal too much. "The single-treatise plan . . . is not only cumbersome in a work of reference, but lent itself to the omission altogether, under the general heading, of specific issues which consequently received no proper treatment at all anywhere in the book; whereas the dictionary plan, by automatically providing headings throughout the work, under which, where appropriate, articles of more or less length may be put, enables every subject to be treated, comprehensively or in detail, yet as part of an organic whole, by means of careful articulation adapted to the requirements of an intelligent reader." "The whole work—and not only the unsigned articles, many of which indeed have . . . high authority behind them—passed through the detailed scrutiny of the editorial staff, whose duty it was to see that it provided what those who used any part of the book could reasonably expect to find, to remedy . . . 'inconcinnities' . . . , and to secure the accuracy in the use of names, the inclusion of dates, and similar *minutiae*, which is essential in a work of reference." Yet we still find the single-treatise plan; we still find the 'omission altogether' of important issues; we still find 'inconcinnities,' not only of secondary articles with main article, but of two adjacent columns of the same article; and we find men signing articles and writing books some years after the recorded date of their deaths. Despite the halo of authority, and despite the scrutiny of the staff, I do not hesitate to say that the great bulk of the secondary articles in general psychology—articles of the type of *Affection*, *Apperception*, *Cognition*, *Intellect*—are not adapted to the requirements of the intelligent reader; and that many of them might as well have been left out. *Apperception*, for instance, is a topic that must be treated historically, and must be treated at some little length, if it is to be understood. The Encyclopaedia prides itself on its historical spirit: "all subjects are treated in these volumes not only on their merits, but as in continual evolution, the successive stages in which are of intrinsic interest on their own account, but also throw light on what goes before and after." Now turn to *Apperception*: consider how much you are told, in what technical terms, with what historical setting, with what kind and number of cross-references! And *Apperception* is a favorable specimen of its class.

I am not arguing that the *Britannica* should satisfy the claims of the specialist,—though there is specialism and to spare in articles which cover other fields of knowledge; I am arguing

that it lacks psychological atmosphere, that it has failed to reproduce the psychological spirit of its time. In America, we are told, "psychological study . . . has become largely a matter of experiment and apparatus." Now the work is dedicated, jointly, to the king of Great Britain and Ireland and the president of the United States; and the Editorial Introduction makes much of the adequacy of the new edition to American circumstances and needs. Moreover, "the object of the present work is to furnish accounts of all subjects which shall really explain their meaning to those who desire accurate information." Appears, then, the intelligent reader,—who asks for an account of this German-American movement in psychology, wishes at least to acquaint himself with its broader features; asks also for the meaning of the movement, wishes to understand the forces that lay behind it. What does he find? He finds—if it is not presumptuous to give my own impression—that the high authorities and the scrutinising members of the staff are well aware of the existence of laboratories, of activity in experiment, of publication of researches; but that they do not know any of these things at first hand. They are therefore a little timid, and they are also a little superior; they make general reference to the movement, where reference seems to them to be in place, but they add a wise word of conservative caution: 'All this is noteworthy,' they say in effect, 'but you must remember that experiments in the laboratory are, after all, artificial affairs; your subject there can never be quite natural.' The intelligent reader, being intelligent, is not satisfied; it occurs to him that the men who use a tool are likely to be aware of its limitations as well as of its scope and powers; and he asked for information and explanation, not for a bare reference and an expression of secondhand opinion. I have already quoted a characteristic sentence from the article *Child*. "Into the psychological characteristics and development of the child and all the interesting educational problems involved it is impossible to enter here." Why? for lack of space? But a whole quarter-page can be spared for a cut of the dandelion. Surely not because the subject is unimportant? Surely not because the intelligent reader will not be forthcoming? Surely not because expert guidance may be dispensed with? ⁸⁸ Why, then?

⁸⁸ Here, indeed, is the usual caution: "There is often a tendency in modern 'child-students' to interpret the phenomena exhibited by a particular child with a *parti pris*, or to exaggerate child-study—which is really interesting as providing the knowledge of growth towards full human equipment—as though it involved the discovery of some distinct form of animal, of separate value on its own account." I suppose that we can find misdirected enthusiasm along all

The same general criticism may be advanced from another side. I have already paid my tribute of admiration to Professor Ward's *Psychology*, and Part 77 of the old *Britannica* has been familiar to me for more years than I like to count. But it is to be remembered that the *Psychology*, close packed as it is, is still no more than the outline of a system; printed in ordinary text-book style, it would fill, I suppose, less than 300 pages. It is not, then, to be compared with James' *Principles*, or Sully's *Human Mind*, or Ladd's *Psychology Descriptive and Explanatory*, or Jodl's *Lehrbuch*; "much that belongs to a full exposition is," as Bain remarked, "necessarily omitted;" and there are not a few "subtle disquisitions" which demand that elsewhere "illustration be duly expanded." I have tried to show that the secondary articles, considered as a whole, neither fill the gaps nor furnish the illustrations. But further: as there is now a large body of experimental work which bears upon Professor Ward's personal theories, so must these theories themselves take account of the experimental work which lies beyond them,—which has dealt with psychological problems as they arose to other points of view. Psychology today is less a coherent system of knowledge than a certain attitude of mind over against a vast collection of special investigations. And a systematic psychology which has not changed in a quarter of a century must either have been phrased, at the outset, in terms so large that the facts of observation are merely blanketed, or must hold its own by force of individual conviction against other systems that have like claims upon the impartial student. I need not say that the system of the *Psychology* is of the latter type. Professor Ward has shown, time and again, that he can come to close quarters with observation; certain results of his systematic thinking have been widely accepted; certain others have, as I think, been superseded. Here, again, therefore, was a pointer for the secondary articles. An article *Attention*, that should do full justice to the experimental situation, might yet keep in touch with the doctrine of the 'single subjective activity;' an article *Feeling*, with the doctrine of impresentability; an article *Action*, with subjective selection. I should be surprised to learn that Professor Ward's dissatisfaction with the secondary articles is not as deep as my own.

Who, then, it may be asked, was in charge of the psycho-

lines of human endeavor. But imagine yourself enquiring the way to a certain place, and being told: You are on the wrong path, but it is impossible here to put you right! And imagine this reply from an official whose business it is to direct you!

logical portion of the Encyclopaedia? We are not told. The Editorial Introduction gives a long list of specialists who assisted the Editor on all sorts of subjects,—natural science, art, and literature, history, applied science, mathematics, philology and languages, and so forth; but in all this 'college of research' there is no psychologist. The Introduction also names the members, English and American, of the editorial staff. I failed to recognise a psychologist; but, to make assurance doubly sure, I traced the departments for which a single authority is declared responsible, and I find that psychology is, in fact, not among them. The inference seems to be that no one in particular was in charge of the psychological contributions to the Encyclopaedia. If this inference is just,—if the failure to mention a responsible editorial assistant is not simply an oversight,—then the Editor's attitude to psychology is made clear, and the defects and errors which I have pointed out, glaring as many of them are, become intelligible. But a twentieth-century Encyclopaedia that has no psychologist either upon its advisory board or upon its editorial staff is, in so far, an anachronism.

APPENDIX

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| A. G. | Major A. G. F. Griffiths, late H. M. Inspector of Prisons. |
| A. L. | A. Lang, British man of letters, author of works on folklore, primitive religion, etc. |
| A. M. | A. Macalister, Professor of Anatomy, University of Cambridge. |
| A. S. P.-P. | A. S. Pringle-Pattison, Professor of Logic and Metaphysics, University of Edinburgh. |
| B. K. | B. Kidd, author of <i>Social Evolution</i> , etc. |
| C. L. M. | C. Ll. Morgan, Professor of Psychology, University of Bristol. |
| C. P. | C. Pulfrich, on staff of C. Zeiss Factory, Jena. |
| E. B. | E. Bramwell, Asst. Physician, Royal Infirmary, Edinburgh. |
| E. B. T. | E. B. Tylor, Professor of Anthropology, University of Oxford. |
| E. M. S. | Mrs. Henry Sidgwick, Principal of Newnham College, Cambridge. |
| F. P. | F. Podmore, author of <i>Modern Spiritualism</i> , etc. |
| F. Y. E. | F. Y. Edgeworth, Professor of Political Economy, University of Oxford. |
| H. H. W. | Rev. H. H. Williams, Lecturer in Philosophy, Hertford College, Oxford. |
| J. B. T. | Sir J. B. Tuke, Medical Director of New Saughton Hall Asylum, Edinburgh. |
| J. E. C. | Rev. J. E. Carpenter, Principal of Manchester College, Oxford. |
| J. G. M. | J. G. McKendrick, Emeritus Professor of Physiology, University of Glasgow. |

- J. M. J. Macpherson, formerly Inspector-General of Hospitals, Bengal.
- J. M. M. J. M. Mitchell, Lecturer in Classics, E. London College.
- J. R. C. J. R. Cotter, Asst. to the Professor of Physics, Trinity College, Dublin.
- J. S. J. Sully, Emeritus Grote Professor of the Philosophy of Mind and Logic, University College, London.
- J. W. J. Ward, Professor of Mental Philosophy, University of Cambridge.
- J. We. J. Welton, Professor of Education, University of Leeds.
- L. C. B. L. C. Bruce, author of *Studies in Clinical Psychiatry*.
- N. W. T. N. W. Thomas, Govt. Anthropologist to Southern Nigeria.
- R. R. M. R. R. Marett, Reader in Social Anthropology, University of Oxford.
- S. C. S. Colvin, Keeper of Prints and Drawings, British Museum.
- W. D. W. W. D. Whitney, late professor of Sanskrit and Comparative Philology, Yale University.
- W. McD. W. McDougall, Wilde Reader in Mental Philosophy, University of Oxford.

Note I.—The Index Volume comes to hand as I am correcting the galley proof of this review. It contains (pp. 939 f.) an alphabetical list of the articles in Philosophy and Psychology; Subjects and Biographies are separated; Philosophy and Psychology themselves, despite the article *Philosophy*, are thrown together. It seems that I have found all the psychological articles, but have missed half-a-dozen that deal with Psychical Research and Occultism.

I have worked out the references under the topical heading Psychology (p. 640), and under a number of special headings; there has not been time for a thorough search. I find that the general heading gives the sub-headings *Ethics, relation to; Logic, relation to; Metaphysics, relation to*,—and as I have not mentioned in the text any discussion of the relation of psychology to other disciplines, I am glad to repair the neglect here. The article *Ethics*, then, devotes twenty lines to psychology; ethics, we are told, must hold its ground against the intrusion of ideas from alien sources, and the conviction of 'the ultimate character of moral obligation' "may produce quite unforeseen results for psychology." *Logic* informs us that metaphysics, logic and psychology form together a 'triad of sciences'; the interdependence is "so intimate that one sign of great philosophy is a consistent metaphysics, psychology and logic." A paragraph under *Kant's Logic* treats of the post-Kantian psychological logic. *Metaphysics* teaches that "to proceed from psychology to metaphysics is to proceed from the less to the more known; and the paradoxes of psychological have caused those of metaphysical idealism." These brief notes must suffice.

The Preface admits that "every index has its humors:" here is an illustration. There is a sub-heading *Pioneers of Physiological Psychology*, and the names to which reference is made are A. Bain, F. E. Beneke, and J. Huarte.

Note II.—I am informed that the error in the statistical tables under *Insanity* appears in the English edition, and was discovered and corrected by the New York office after the American reprinting had begun. Early American sets thus contain it, while later sets are correct.

THE FUNCTION OF THE SEVERAL SENSES IN THE MENTAL LIFE¹

By EDMUND C. SANFORD

In the following paragraphs the author attempts to sketch the functions of the several senses in the general mental economy, in somewhat the fashion in which a field naturalist might describe the rôles of the several forms of animal and vegetable life in some district under his observation. He begs the reader's indulgence, therefore, if he speaks first for a moment about well-known matters in order that both may start from common ground.

We have, as everybody knows, sensations of sight, hearing, smell, taste, and touch, sensations arising from posture and movement, and in addition, sensations of pain and indefinite general and organic sensations. We know that through these in various measure we receive impressions from the outer world and from our own bodies, that in response to data furnished by them we adjust ourselves to the world about us by means of movements and that in images derived from them we do a large part, at least, of our thinking.

Our first question is: *What part of these images, in which we do our thinking, does each sense furnish?* We are not especially interested to follow back the sensory elements to their utmost simplicity, but rather to study them in their combinations, in the perceptive and other complexes in which we always find them when we can actually observe them.

Let us take the senses one by one beginning with touch.

Touch is a sense world in itself. We group together under that name sensations of heat, cold, pressures and contacts,

¹ This essay has been read, in substantially the form in which it here appears, as a lecture before the departments of psychology in several colleges and universities. Besides the works referred to in the text, the following have been drawn upon in its preparation:

Obersteiner: *Zur vergleichenden Psychologie der verschiedenen Sinnesqualitäten*, Grenzfragen d. Nerven- u. Geisteslebens, VI, 1905, Heft 37, 1-55.

Kant: *Anthropologie*, Werke (Hartenstein Edition), VII. 465ff.

Wundt: *Grundsätze d. physiol. Psychologie*, *passim*.

Ribot: *Evolution of General Ideas*, tr. by Welby, Chicago, 1899.

The author would also note his indebtedness to his friend Professor Henry Taber of the Mathematical Department, Clark University, for helpful suggestions.

all of which show local differences as one part of the skin or another is stimulated. From the dermal surfaces we also get pain of a definite kind. In active touch we not only have these passive experiences, but a whole new set as well, giving us information as to the position and movements of our members.

Passive touch is a sense of great immediacy. With the partial exception of heat and cold, it responds only to excitations that are applied directly to the skin itself and reach the nerves directly, or through but few intermediaries, as simple mechanical excitations. Mechanical stimuli must of course, like all other kinds, suffer transformation into nervous processes before they can reach the conscious levels of the central nervous system, but this simplicity and immediateness are not without their significance.

Touch resides in what is by far the most extensive of the sense organs,—the whole dermal covering of the body and much of the mucous surface,—and what is still more important, it has a very close and varied connection with the muscles. It has been plausibly conjectured that an important factor in the tactual "local sign" or special difference in character by which any given dermal impression is referred to the one part of the body surface to which it belongs, is a reflex tendency to bring the hand to the spot stimulated or to turn the eye so as to look at it. The same motor connection is shown by the violent start of surprise that follows an unexpected touch. There is hardly anything that will produce a more violent and general muscular contraction than a fully unexpected slap upon the shoulder. The shortness of touch reaction-times probably points the same way, as do, certainly, the variety of reflexes that follow dermal and mucous excitations. All this in the case of mere passive touch,—where the sensory surface simply receives what comes to it. With active touch the connection is still more intimate. The inner touch sensations (the capsular, muscle, and tendon sensations) are not only directly dependent upon bodily movements for their specific stimuli, but supply one of the handles by which we manipulate our members in voluntary movements. Interference with the usual inflow of sensations from the members in movement makes the movements themselves uncertain or impossible, except as vision serves as a vicarious guide. Touch, active and passive together, is pre-eminently the sense of closest motor connections. This also has its important meaning in the psychic life in general.

In another particular the sense of touch is peculiarly endowed. It is the only sense that has an organ that can

be doubled upon itself. The eye cannot see itself; the ear cannot hear itself; nor the tongue taste, nor the nose smell itself; but the hand can pass over the whole body surface, and in so doing both feel and be felt. The eye can, in a secondary fashion, see the body surface and follow and guide the movements of hands and feet, and the ear can hear and control indirectly the sounds that the vocal apparatus produces; but the touch surfaces alone can perform in perfection this ultra-philosophic feat of being at one and the same time both subject and object. The feelings of double contact that arise when two touch surfaces are brought together have, like the immediacy of stimulation and the close connection with muscular movement, a special meaning in the psychic life in general.

Touch has also other characteristics that are perhaps worth mentioning in passing, though their connection with our main problem is not so close. In power to stir emotion the sense stands high. A cool plunge into a swimming pool, the warmth of an open fire, a caress on hand or cheek, the kiss, the embrace, the shock of personal assault all testify to this. Touch is intimate; what stimulates our dermal surface concerns us closely. It touches us in more senses than one.

Touch is a sense in which man exceeds most of the animals. Others may excel him in keen discrimination of odors; perhaps others in vision; but few can compare with him in touch. It is hardly necessary to recall the general covering of fur, feathers or scales that most of the other animals have, and the inadequacy of fins, claws, paws, lips, or even of probosces, for fine palpations. And with the monkey tribe the hand, though ready in form for touching, is not yet free from general bondage to locomotion. There are a few exceptions. Prof. Whitman has showed an astounding sensibility to touch or jar in certain leeches; but as against most animals man's superiority still holds. Manual deftness in the surgeon or in the engraver is not alone a matter of eye and of muscle but of refined tactual sensibility as well.²

²I remember reading many years ago of a cracksmen who was able by touch to discover the combinations of the safe locks then in use. He scraped down one of his finger nails almost to the quick, and holding this against the lock was able to perceive the faint jars produced by the movements of the inner parts of the lock as each was brought to the point required for opening. To learn the combination was then but a matter of a few trials, and the safe was open. Whether this story is true, I do not know, but there is no *prima facie* impossibility in it. At all events the main point stands that the hand is not alone a tool-holding mechanism but a sense organ of high power.

Touch is also a very ancient sense. It begins far back in the animal series, and is active from very early in the individual life history—at first in the tongue and lips, later in the hands and fingers. It is perhaps a mistake to regard it as the mother sense of all the other senses, as is sometimes done. The unicellular creatures react to light and chemical excitants as well as to contacts; and one is hardly justified in saying that everything comes from touch more than to say that everything comes from the primitive capacity to see or to taste and smell.

Nevertheless the statement seems to carry some truth with reference to two of the senses, the rotational-equilibrium sense and the auditory sense, both of which have their end-organs in the inner ear. The morphological series that connects the one with the other seems to have been made out with some exactness. The dermal surface first develops a little sensory pit which later in the series becomes closed in and sometimes contains a granule of calcareous matter. The organ thus formed serves indifferently as an organ for sensing bodily movements or for shocks and jars coming through the surrounding medium. To serve one of these functions come, in course of differentiation, the semicircular canals of the inner ear and their connected parts, still an organ for the indirect regulation of bodily movements, especially those involving rotation and the maintenance of equilibrium, and for the other, much later, the cochlea and the mechanisms responsive to the aerial jars that we sense as sounds. The functional relation is so close between the kinæsthetic organs of the inner ear and those of inner touch (the capsular, muscle and tendon senses) that the derivation seems not unnatural.

In the case of the auditory part of the ear the connection is much more remote. The auditory part of the ear is at most the grand-daughter and not the own daughter of the sense of touch. And yet it maintains at one or two important points the family resemblance. It is still a mechanical sense and responds to actual mechanical impressions upon the nerves, though very delicate ones, and it is very closely connected with the general muscular system both in the central terminations of its special nerves, and in the outer physiological effects of its stimulation. A sudden and loud sound produces as violent a start of surprise and terror as an unexpected blow; babies wink at sounds long before they do to threats at the eye, and start and begin to cry at the slamming of a door. The auditory reaction-time is as short

as the tactual, and probably for the same reason. And perhaps most interesting of all, rhythmically repeated sounds enter in through our ears and play upon our muscles for themselves, compelling us to keep time to them whether we will or not, and giving to rhythmically repeated sounds and movements the profound power over us which they undoubtedly exercise.³ And finally hearing, like touch, is a sense that is always exposed to excitation and one that can obtain no mercy when within the range of its stimuli.

The differences are, however, no less fundamental. If the ear is still a mechanical sense, it does not require immediate contact with the sound-producing object; it receives at long range the air vibrations that betray the latter's presence; its sensations, therefore, bear a more objective and impersonal character. It tells us of events in the world at large and not so much of our own states and activities.

Because of the biological advantage of this long range function, the ear has gained in keenness and in variety of sensibility until its contribution to the mental life has reached large proportions. Because of the same refinement and range of sensibility it has become also a sense of indirect perception and of sensory inferences; we infer by their sounds many things which we do not otherwise sense; to take single instances, we know it is raining by hearing the patter of the rain on the roof, and the doctor diagnoses the condition of the organs of the chest from the sounds of heart and lungs. And the most important contribution of the ear to the mental life in general—one of transcendent importance—is in a measure but a further development of this habit of indirect perception—I mean the verbal signs of language, which it has developed in coöperation with its special motor partner, the voice. Of language I shall have more to say presently; I merely mention it here, and pass on to speak of vision.

Vision, like touch, is a sense of ancient lineage and of early development in the individual life. Like hearing it is a long range sense, taking note of things not directly but through the operation of the light which they emit or reflect. Unlike touch and hearing its connection with the general muscular system is not particularly close; but in compensation it has a tolerably complex motor apparatus of

³ A slightly different example can be found in the effects of the crack of the whip and the pistol shots on the behavior of the big cats in Bostock's and other similar groups of trained animals. One can fairly see the sound stimulus playing upon the reluctant motor centers of the animals and forcing them to do in spite of themselves the things which the trainer requires.

its own. In its original function as a light perceiving sense it is as far as possible from the mechanically stimulated sense of touch; and yet it has in the retina an extended sensory surface not unlike the skin, and this, with its correlated muscles, gives vision a certain physiological analogy to touch. From very early in life also it exercises a supervisory function with regard to that sense, and in course of time comes to be very closely bound up with it, and indeed fully to justify its description as "anticipatory touch." In giving us chiefly a spatial world of things, it also stands very close to touch—much closer than does hearing. But like hearing, again, it has developed an immense power of secondary or inferential perception, far more indeed than has the ear. It thus becomes the general business sense of the mental world; and can serve on occasion directly or indirectly in some degree in place of almost any of the rest. Things look hot or cold, rough or smooth, appetizing or disgusting, one is aided in understanding a speaker by watching his lips, etc., etc.

In its own field its chief characteristic is the clearness and precision of its data. Beside it the other senses are dull and groping. It furnishes the very standard by which we measure intellectual comprehension. When a thing is as clear as day, i. e., as clear as seeing by daylight, it can be no clearer. This clear precision it probably owes, on the one hand, to the microscopic fineness of the retinal elements, and, on the other, to the dominant control that vision usually has over attention. Its contributions to the general mental life rest upon the three following qualities chiefly: that it is a long range sense, dealing with a world of outer things; that it is a sense that serves readily, though indirectly, for other senses; and that it is a sense that usually carries attention with it.

Of the senses of smell and taste there is little that need be said here. Smell is without doubt in man a survival—a sense that once stood high and is now for practical purposes almost negligible. Phylogenetically, and in certain creatures yet, it far outranks even vision as a long range sense. Under its influence it is probable that the development of the cerebral hemispheres themselves began. Time was when the nose was the organ of mind. It seems to have lost this leadership when man took his erect position and lifted his nose from the ground. For civilized man, at any rate, both taste and smell might be lost with very small inconvenience, though perhaps with some slight loss of pleasure.

Of pain and the general and organic senses we must say

a little more. To pain it belongs more than to any other sense to mould behavior directly, though it works, in a negative way, forbidding, like the demon of Socrates, certain courses of action, without recommending others except by implication. In compelling power over attention it exceeds vision itself a hundred fold; and it gives to the mental life, as to life in any of its aspects, a color of stern reality. To treat my topic fully I ought to speak of this in detail, but I am not prepared to do so; it would take a book to discuss it adequately, and I must also for the rest of my space limit myself rather to the intellectual aspect of the mental life, and neglect the emotional and the volitional.

For much the same reason I shall have little more to say of the general and organic sensations than to remind you that they resemble in quality the various forms of touch; and that with the dermal and kinæsthetic senses, they form, on the one hand, the substance of our sensory experience of ourselves, and, on the other (as the sensory basis of emotion) the staple of our life of feeling.

We have now passed in review the chief senses and have indicated some of their characteristics. Let us as the next step take two or three sorts of mental experience and see how the several senses stand in regard to them. First of all dreaming. Most dreams seem to be chiefly in visual terms. Hearing occurs frequently, but most often as the hearing of spoken words. Touch sensations are present by implication, but are not usually in the focus of consciousness. General and organic sensations are present in the same implicit way, in emotions and bodily consciousness of self, but rarely otherwise. I do not know whether images of pain are ever present in reality; and at any rate one not infrequently wonders in his dream at the painlessness of conditions that he thinks ought to be painful. In dreams as in waking life vision is clearest, and largely monopolizes attention; hearing is present as the social and language sense; and touch and organic sensibility, unilluminated by attention but nevertheless operative, form the background, especially of emotion.

If we turn from the common hallucinations of dreams to the less usual ones of the waking life, such as have been collected by the Society for Psychical Research, we shall find vision again leading, with audition second and the rest

behind.⁴ And even with the insane the only difference is the interchange of relative frequency between the ear and eye.

Of illusions (the mistaken perception of a real object as opposed to inner creation or hallucination) the eye seems to possess an almost undisputed monopoly. We hear of optical illusions till we might think there were no others. It is strange at first approach that this clearest of all senses should be thus subject to illusion, but the reason is not far to seek. The eye is easy to fool because so many of its perceptions are inferential. A little something unusual in the data or a little something omitted leads to a false inference. The eye owes its wealth of illusions to its superlative power of indirect perception. It has the defects of its virtues.

The chief characteristics of the different senses come out again in the fine arts that they subserve. Based upon sight we have the two great arts of painting and sculpture, and that part of architecture that is devoted to beauty of form. It is, however, as representative that these arts make their most direct appeal to us. The beauty of color or form alone, while not to be neglected, is a comparatively small factor. It is what the picture or statue means or suggests that moves us. With nothing more than the pure visual sensations, the visual arts would have remained on a low level—perhaps hardly above the level of simple decoration. They rise above that in proportion as by representing something they reach the broader and deeper human interests. (I am speaking here, of course, of the normal response of the naïve observer. For the artist or critic there is a special “professional” pleasure in the skill of the execution and the particular way in which the artist produces his effects. This pleasure is mediated by vision, but is, of course, intellectual rather than sensory in its quality.)

The peculiar art of the ear is the art of music—an art that makes an especially direct appeal to us (partly through rhythm and partly through the roots it sends down into the primitive emotions through its resemblance to the vocal expression of emotion). It is not compelled like the arts of form to represent something; it works upon us directly. The nearest approach to a purely visual art corresponding to the auditory art of music is to be found, as Santayana sug-

⁴ It should be noted, however, that Parish (*Hallucinations and Illusions*, London, 1902, p. 108) holds that visual hallucinations are not more numerous, but merely more frequently noticed and better remembered.

gests,⁴ in the art of pyrotechnics, i.e., fireworks, where form, color and movement are united to produce pleasure by their immediate effects and not by representing something else. Poetry, like music, belongs to the ear, but by means of language (auditory symbols in the first instance) it can appeal indirectly to all the senses and becomes representative like the visual arts. The drama gives pleasure, of course, to both eye and ear; and dancing to the eye and vicariously to the muscle sense. (Again I am speaking of the pleasure of the naïve observer; the professional has his professional pleasures as before; and in music there is for those who can follow it the musical logic in the development of the theme and of the musical form as a whole.)

The art development of the remaining senses is rudimentary and need not detain us.

You will notice that the arts that appeal to the eye depend upon its facility in sensory inference; while music, in its purest form, depends more directly on the ear and its powers of reading movement and emotional condition in the changes of inarticulate sounds.

And now the reader may perhaps be asking why I do not try to arrive at the function of the two chief senses at least, by the method of elimination—why I do not consider the mental life of those who have lost sight or hearing or both. I am ready to speak of them here, and they will serve to show us some important aspects of the mental life, but not quite in the way implied. The fact that comes out most clearly of all, when we study the cases of those who have suffered the loss of one or both of the chief senses, is the *smallness of the loss in any case for the mental life as a whole*, provided only that circumstances have been such as to supply sensory experiences of some sort in sufficient variety. Let us take extreme cases. Take Laura Bridgman and Helen Keller: What of a full mental life do they come short in? Practically in nothing but in the particular sort of bare sensory experiences which their misfortunes have cut them off from, and this is really very little; certainly they are not defective in any essential element of a full human mental life. They can think and feel as vividly and through as wide a range of feeling and thought as any one. What shall we say to this? Two things: In the first place they have retained the sense of touch which in a short-range way can serve for all dealings with the world of people and things, and, when

⁴ Santayana: *The Sense of Beauty*, London, 1896, p. 75.

trained, can serve as a language sense equal almost to hearing itself. And secondly, and this is the point to which I wish to draw special attention now, *the developed mental life is not a matter of immediate sense experiences* but of the representation and manipulation of sensory and linguistic symbols. The sensory experiences furnish materials for the manufacture of symbols; and the mental life, at least on its intellectual side, consists in manufacturing and correlating them. As a general thing it matters comparatively little what sense furnishes the material for the symbols, provided that it is furnished. In normal cases material for symbols of different kinds comes in through the different senses; especially through hearing and vision. Without special training, i.e., without the furnishing of touch language symbols, etc., persons with defects like those of Laura Bridgman and Helen Keller are predestined to very imperfect mental development.

The symbols derived from the different senses long bear the marks of the senses from which they spring. It is to the characteristics of some of these symbols and the manner of their development that I wish to devote the rest of my space.

First let us start with simple perceptions and see how a symbol of some abstractness gradually grows up. To perceive a thing is in some sense to take it out from its setting and to regard it, in attention at least, as a separate thing. In those sense fields where a considerable variety of sensation is possible, the whole mass tends of itself to break up into separate groups of a more or less permanent nature, and instead of a variously featured whole we get a mass of separate things. We see a room full of furniture with pictures on the walls and books on the table, for example, and not a mere variegated visual field. But of these separate things, even, we do not get photographic copies. We get instead mere sketches in which certain aspects are sharply and clearly brought out, and others are barely indicated or wholly omitted. The sense groupings are determined in a general way by our environment, but they get a special perspective in their parts that is dictated by our human needs and purposes. Things are perceived with an implied meaning, and that meaning is dictated as long as we are on the common practical level, by what we can do with the things or what they will do to us. It is said that a savage's first questions with regard to a new object are apt to be; "Will it hurt me?" and "Can I eat it?" This is doubtless a slander

on the savage; nevertheless it caricatures a characteristic mental attitude and one that leaves its impress on all our percepts. We look at a chair as something to sit upon, and we usually neglect the fact that it is also a wooden object and may, in case of need, be used for making a fire. We look upon sheep in the pasture and mutton on the table as quite different things, neglecting in each case what is prominent in the other.

These last examples are cases of what psychologists commonly call *apperception*—the perception of a thing with a meaning—but perception and apperception are in reality the same thing and pass into each other by imperceptible gradations. There is no essential difference in kind, merely one of complexity, of degree, between the simplest case of perceiving a taste or smell and apperceiving a social action as one which is in the long run detrimental to the common good. Perception and apperception consist essentially in omitting certain aspects and retaining and emphasizing others, omitting those that are unimportant for the matter in hand and stressing those that are important—those that have (or constitute) the meaning.

And we need not stop here. This is the same sort of selective action that is operative in the formation of all concepts and abstractions, or symbols, of objects and relations. We abstract, or pick out by attention certain aspects of our knowledge about chairs for our common dealings with them, we neglect others. We take certain essential aspects of concrete cases of just actions to form our concepts of abstract justice, and leave those that are not essential. We take certain aspects of actual physical objects to form our concepts of matter, and we leave out the rest. We take certain other aspects of groups of things as the basis of our abstract concepts of number, and neglect all the other aspects. And so with all the rest. Only one further step is necessary to the completion of general concepts, however general and however abstract; and this is one that often takes care of itself, namely, that the instances in which like aspects appear should somehow come together and be associated, and then get some sort of a distinctive name or language symbol.

This is as far as we need to follow the process at the moment. When we have once gotten our name or language symbol we can do pretty much what we like with the concept so long as we do not separate it from its definite meaning, and so long as we keep the way open for a return to the concrete experience when we need. Ribot, if my memory

serves me right, has compared the whole process to the development of the different means of managing commercial exchanges. At first there is simple barter; things are swapped for other things. Then one of these, perhaps the most frequently exchanged, is taken as a measure of value; so many cows, for example, for so much grain, or so many for a piece of land. Later bullion is substituted for cows, as more portable and more universally desired; then by and by coined money. Later still come paper money, bank checks and other evidences of credit. These add greatly to our convenience, but one and all have value only in so far as they rest upon an adequate basis, and can, in case of need, be turned into the various concrete valuable things for which they stand. Similarly with the abstractions and their symbols; they facilitate thinking, but have a genuine meaning only as they can be reduced in case of need to the concrete experiences from which they were originally drawn.

Now let us return to our chief sense modalities and ask for the special concepts that each furnishes, that we may see how far these carry the marks characteristic of their origin, as I have said they do. From touch and sight in coöperation we get our conceptions of space and movement; from touch and the kinæsthetic group of senses the fundamental qualities of matter—impenetrability, mass, weight, inertia, force—and from the kinæsthetic group, in free or hindered movement, our sense of personal freedom or constraint. A blind and deaf man might be a physicist; it is doubtful if a totally anæsthetic and paralysed man could be, because he could not frame the fundamental physical ideas, or if he would have any idea of personal freedom. From touch also come our fundamental ideas of reality. That which can be touched and handled is real for any doubting Thomas; that which can be seen or heard but not touched is a ghost. If we all, in spite of efforts to the contrary, take matter as the prime type of reality and refute Berkeley by kicking a stone, it is because we instinctively fall back upon our primal sense of touch.

Touch furnishes us, as I have said, a considerable part also of that mass of fused sensations that constitutes our perceived selves, though vision also and the other senses do something. It is here that the feelings of double contact are important. From our own persons we get double contact sensations, from all else single. We feel and see parts of ourselves, and we live in a peculiar way in the parts of our persons that we can feel and see. One of Du Maurier's

pictures in *Punch* represents a little girl trying not very successfully to tie her sash behind her back. She finally appeals to her aunt who stands by. The aunt replies: "Why, Alice, you are such a big girl now, you ought to be able to tie your own sash." To which the little girl retorts: "How can I, Aunt, when I'm in front." We are all of us chiefly in front. And yet even touch itself furnishes but the outer and less important part of our empirical selves. A deeper self is the self of feeling and emotion, the self that loves and hates, that strives and aspires, that enjoys and suffers; and for this another group of senses is chiefly responsible—that inner group of general or organic sensations. It is of the reverberations of excitations within the field of these inner senses that the moving part of our emotions is constituted. The loss of feeling robs us of all that part of ourselves that makes life or anything else valuable. And that part of ourselves we owe chiefly to our general and organic sensations.

To sum up briefly I may say that we get from the chief senses singly or in coöperation four characteristically different abstractions: From touch we get the world of space and material reality, and force acting upon us; also, from motor touch, energy, active efficiency and freedom; from vision we get space and the world of things, though in a somewhat different way from that in which touch gives them to us; from hearing we get our symbolic machinery of thought; from the general and organic senses, our most intimate intuitions of ourselves and the basis of our emotions.

We can tell whether these bear the marks of their sensory origin only by thinking of the meaning of them and seeing whether they still carry a sensory suggestion. Matter and solid reality, when I myself try to give them definite meaning, suggest at first something visual and then if pressed further something palpable, something that resists movement. Freedom suggests free swinging of the arms and body movements, and efficiency something like a physical pushing. Unfilled space, if taken as remote, is that which can be seen through, and, if near, perhaps in addition that through which the hand may be thrust. The feeling self resides for me in the chest, or at least "in front." These are but a few illustrations, but there can be little question that these abstractions all carry the marks of their origin, or still lie close to it; and it is but natural that they should do so, since they have been reached by a process of subtraction of temporarily unimportant aspects. These special cases are of course all instances in which we have been trying to get a somewhat

concrete meaning for our abstractions, to exchange our paper money for coin. But at the same time we must remember that it is only as we can ultimately reduce them in some such way that they really have any meaning at all.

But now assuming that sensory marks remain upon most abstractions, and sensory experiences furnish them with such meaning as they have, what follows from it? I reply that certain very definite limitations follow from it. I tried in a paper several years ago⁵ to show that the symbols (or abstractions or concepts) of physics had an underlying basis in the experiences of the dermal and kinæsthetic senses, and for that reason physics could not be expected ever to be able to furnish a full and satisfactory explanation of psychic experiences derived from other sense modalities; in brief, that we never could get a satisfactory explanation of the whole psychic life in terms of matter and motion, the fundamental concepts of physics. We cannot, for example, expect to explain the quality of a taste or a smell or a pain in terms of sensations of pressure or of the kinæsthetic group, much less all psychic life. The concepts of physics tend, in a word, to state all physical phenomena in terms ultimately reducible to dermal and kinæsthetic experiences, and by that very fact physics is prevented from explaining anything that lies outside the field of dermal and kinæsthetic experiences, because of the impossibility of translating one sort of sensation into another sort. It is *disparateness in sensory origin of the concepts* that makes the great gulf which has been said to lie between the self and the external world. We can leave out what we like in forming any abstract concept, or symbol, but we cannot leave out everything; and what we retain fixes the field in which the laws that we reach by use of that abstraction will prove necessarily applicable.

We can in some cases indeed transfer meanings and use symbols derived from one sense as carriers for meanings derived from another sense, as for example, when we treat geometrical relations by algebraical symbols in analytical geometry. But this is merely a transfer of the language signs, i.e. of the signs of symbols, and not of the original symbols themselves. In every case the meaning must come from somewhere (i.e., ultimately from some sensory experience) and the meaning then gives limits to the symbols as if they had originated along with it.

What I have just said of the limitations of physics is true, however, only in so far as physics finds its problems in

⁵ *Psychology and Physics*, Psy. Rev. X, 1903, 105-119.

dermal and kinæsthetic experiences, that is in the physical world as we know it. There may come very likely a stage at which a metaphysical or transcendental physics will arise in which the symbols will be varied arbitrarily, and then the specific marks of the physical senses may be left out. Mach, in his little book on "Space and Geometry," suggests such a development.⁶ Something of the kind seems actually to have taken place already in the symbolism of mathematics, where the abstractions have been carried to a very high degree of tenuity and where symbolism has been most diligently elaborated. In the work referred to, Mach shows in interesting fashion how geometrical space has grown up from our original physiological apperception of it, and how the science of geometry has developed from the practical necessities of land surveying and other measurements, suffering gradual transformation also, until now it is a science of pure space—a science that criticizes and experiments with its own concepts, and gives us geometries of spaces that we never experience—spaces that are curved, in which parallels may meet, and in which there are four, five or n dimensions. These are of course as far beyond immediate intuition in thought as they are beyond direct perception by the senses. It has become a mere question of the relations of symbols to which certain meanings (and not necessarily spatial meanings) have been reserved, while other and practically necessary ones have been omitted.

In the modern theories of number mathematical symbolism has perhaps reached a still higher pitch of abstraction. There, it would seem that everything has been reduced to a concept of sequences, or as we might phrase it psychologically, to concepts of change according to a certain law, or principle. It need not be change of direction, nor of quantity, nor of quality, but simply change according to some plan. And the interesting point for psychology is that the mathematicians seem here to have been able to shake off at last the special marks of the outer senses, and to have retained as the sole content of the concept attenuations of a purely inner and subjective character, i.e., aspects of sensations in general. The supersensual developments of geometry above referred to seem to have reached nearly this same pitch. The mathematicians would say at once that the formulas of transcendental geometry apply to any sorts of manifolds with aspects related in the ways represented by the symbols, not to space alone. Considered psychologically the progress of the mathematical con-

⁶ Mach: *Space and Geometry*, tr. by McCormack, Chicago, 1906.

cepts has been from those distinctly empirical and of the senses, by gradual elimination of the sensory elements, to those that are distinctly reflective—distinctly of the mind, to mental forms in the sense of Kant. They are symbols of relations, perceived by the inner eye of conscious attention, not of external objects of sense. The progress has been from without inward. And this tendency is inherent in the development of all concepts provided that they are pushed far enough and made abstract and general enough, i. e., if enough is left out of them. Beyond these general subjective forms, however,—fundamental characteristics of all varieties of sensory experience,—even mathematical abstraction cannot go, because to leave out these would be to make the concepts entirely empty and void of meaning. Beyond these lie only the fundamental conceptions of pure logic, which are by profession contentless and for which the experience of cognition is in itself a sufficient psychological source.

THE RELATION OF PRACTICE TO INDIVIDUAL DIFFERENCES

By FREDERIC LYMAN WELLS, Ph. D., McLean Hospital, Waverley, Mass.

A fundamental problem of experimental psychology has to do with the way in which individual differences are produced. In general, it is apparent that such differences are manifestations, on the one hand, of differences in original nature, where heredity plays perhaps the predominant part; and on the other hand, the product of special education and experience.

On the mental side, the various psychological experiments afford us measures of individual difference in the particular functions with which they may be concerned. The question at issue concerns the extent to which these differences, as we meet them in every day laboratory experience, may be fundamental, inherent in the original nature of the individual, or may have been produced by special environment and training.

Some light on this question is here sought through the medium of the practice curve. Given functions in which the individual differences are sufficiently distinct, and in which the normal performance lies sufficiently far from the physiological limit, the following postulates may be formulated:

(1) The nearer the subject is to the end of his practice curve, the less prospect of improvement he has before him; and the further he is from the end of his curve, the greater his prospect of such improvement.

(2) If a high initial efficiency is the product of greater practice, then the expectation of further practice improvement is small; conversely, if a low initial efficiency is the product of lack of practice, then the expectation of improvement under special practice is great.

(3) If, on the other hand, a high initial efficiency be the product, not of a greater amount of practice, *but of greater ability to profit by a given amount of practice*, then the expectation of improvement under special practice is great; and conversely, if a low initial efficiency be the product of

little ability to profit by practice, then the expectation of improvement under special practice is correspondingly small.

The experimental problem is, then, to examine the relative frequency of application of the two latter propositions, not, of course, regarding them as mutually exclusive. This may be attempted in studying the practice curves of suitable tests in a number of subjects, observing the relation of initial efficiency to the amount of practice improvement.

The special precaution that must be taken in selecting such tests is to see that the most efficient performances in the normal distribution do not lie too close to the physiological limit of efficiency. If this be the case, as it is for example in the free association test, the poorer performances will simply catch up with those which are already near the limit; and while this has its specific effect upon the individual differences, it is not subject to interpretation by the above reasoning. As a criterion in this respect, the present experiments would suggest that the highest efficiency reached during practice by some subject should be at least twice as great as the highest efficiency of any subject at the beginning of special practice.

This condition is best met in the complicated arithmetical problems, where the physiological limit is indeed negligible when compared to the higher mental time; but in these tests are certain difficulties in scoring, as well as, perhaps, in the assurance of cooperativeness, that seemed to outweigh this advantage, and to favor the selection of a simpler form, as one of the addition tests. Here the necessity of a wide range of experimental material practically confined the choice to the Kraepelinian *Rechenhefte*. These contain vertical rows of the figures 1-9 in practically random order, 32 to a column, and 9 columns to a page, thus 18 to the two pages of the open *Heft*. The experimental task is to add each successive pair, i. e., the first and second digits, then the second and the third, etc. There are thus 31 additions to the column, 558 on the two pages of the open *Heft*. There are 24 pages, affording 11 double pages. There was scored the number of additions made each minute during five consecutive minutes, the total being taken to represent the efficiency of the performance. The additions were spoken aloud by the subject and followed upon a specially constructed key giving the correct answer in each case. False reactions can be noted in this way, but as they do not affect the results no account

is taken of them here; in general, the greater number of false reactions were made by the slower adders.

The other test was a modified *A*-test, consisting of 1000 of the figures 0-9, 100 of each, printed upon a space $5\frac{3}{4}$ " by $3\frac{3}{8}$ ", and so arranged that each figure occurred an equal number of times in any position. The subject is instructed to check as rapidly as possible the five zeros in each line, and the time required for this was taken to represent the efficiency of the performance. The two tests are hereinafter termed respectively the "addition test" and the "number-checking test."

A group of ten subjects underwent these tests daily, six days in the week, for a period of thirty experimental days. The subjects were nurses in McLean Hospital, five men and five women, of ages varying from 21 to 35 years. The work performed each day consisted of five minutes of addition, and on the first ten days one record of the number-checking test; while on the succeeding twenty days five records of the number-checking test were executed each day. The times of day were regularly the same for each subject. No noteworthy difference in cooperativeness was evident, but it did seem that, as indicated in a previous study, the monotony of the experiments affected the attitude of the women more than that of the men. On the other hand, it may well be that the factor of competition was stronger among the women, since, as is perhaps not unnatural, they appeared to exchange notes regarding their relative positions in the tests to a much greater extent than the men.

The results are, so far as possible, presented in the form of curves, showing the practice changes from day to day in each of the tests. Two sorts of curves are plotted for each test; those showing *absolute gains*, and those showing *relative gains*. In the case of the *absolute gains*, the standard of measurement is for the addition test, the number of additions spoken in five minutes; for the number-checking test, the standard of measurement is the number of zeros checked in one minute at the average rate maintained during the test. In the case of the *relative gains*, which are not reproduced here, the first day's performance in each test is taken to have the value of 100; and the curve is formed by the percentile values of this quantity attained in the succeeding day's practice. Here the curves are all reduced to a common denominator, and there is illustrated the proportionate amount of gain in each subject, independent of gross capacity.

The curves are presented and discussed in the following order:

Plate I, Absolute Gains in the Addition Test, Men.

II, Absolute Gains in the Addition Test, Women.

III, Absolute Gains in the Number-checking Test, Men.

IV, Absolute Gains in the Number-checking Test, Women.

The same color indicates the same subject, except as between the men and women; and the colors for the women subjects correspond to those already employed in a previous paper on practice effects in free association (this JOURNAL, vol. XXII, pp. 1-13).

Plate I, therefore, represents the absolute gains of the men in the addition test. Save in the case of ORANGE, the subjects here consistently maintained the same order of efficiency given in the initial performance. BLUE is not only the distinct leader throughout, but even draws slightly away from the nearest competitor; thus showing, in company with the greatest initial efficiency, the greatest absolute gain. While the record doubtless eliminated the initial spurt of practice, the performance of the last three days would certainly indicate that the limit of practice had not been reached. Substantially the same is to be said of the second subject, BROWN. Here the amount of absolute gain is during the earlier days of the practice, the greatest gain of all, and throughout closely approaches to that of BLUE. The limit of practice was evidently not reached. RED shows substantially the same absolute gain as BROWN, perhaps a little more, though it comes with greater slowness, and was, at the close of the experiments, apparently nearer its end. In the case of the subject with the lowest initial efficiency, GREEN, the absolute gain is least, and also slowest, saving the exceptional case of ORANGE. This subject, while commencing with an initial efficiency but slightly below that of BROWN, shows so little practice effect as to place his absolute gain quite in a class by itself for smallness, beside which those of the remaining subjects are relatively equal. The form of the curve would not indicate that the subject was near the limit of special practice, for it does not rise with exceptional slowness at the start, and, in fact, shows a relatively rapid rise at the close. In sum, it would then appear from these curves that the amount of absolute gain was for four of these subjects nearly equal, in spite of great differences in initial efficiency; the slight difference in absolute gain rather favoring those of greater initial efficiency.

The case of ORANGE apparently involves a fairly good inherent ability, with unusual insusceptibility to practice in this function.

The records also of the women as given in Plate II show some independence of initial performance and practice effect. Much the greatest absolute gain is shown by RED', who stands third in efficiency on the initial day. The speed ultimately reached by this subject is the greatest the writer has observed in the test, and was probably not far from physiological limits imposed by the speaking of the responses. The subject had reported that she could mentally add figures ahead of where she was speaking, though in a subsequent record, where the responses were not spoken, the performance was but little in excess of that with the spoken. The next greatest absolute gain, in a performance somewhat similar to that of the corresponding color with the men, is that of BLUE'. The initial performance is the best, and the absolute gain much the greatest of the four subjects besides RED'; nor was the end of practice in sight. The subject second in initial efficiency, GREEN', makes a very slow absolute gain, which, however, persists until it finally stands next to that of BLUE. It would evidently have progressed further. ORANGE', who occupies a distinctly lower place in initial performance, has an absolute gain more rapid at first, which soon ceases, apparently for good, at a level definitely below that of GREEN'. The smallest absolute gain is found in the subject with the lowest initial efficiency, BROWN'. In the amount of absolute gain there is much more difference among the women than among the men, and in sum they further illustrate the same thing as was indicated by the men. The greater absolute gain may well follow the greater efficiency of initial performance; this being now associated with the striking exception of RED', of the opposite character to that of ORANGE in the men.

Turning now to the records of the number-checking test (Plates III and IV), we find that in this function the curves of the different men subjects spread out like a fan, with the greatest absolute gain shown by the second subject, and the smallest by the subject of lowest initial efficiency. The record of BROWN dominates this plate as completely as those of BLUE and RED' the two preceding. BROWN nearly equals the best initial performance, and its ascent is the most rapid and the furthest. The best performance, some 38 seconds for the entire blank, must lie very near the physiological limit for the test. With an initial performance a little above, GREEN shows a much inferior practice effect, though pre-

serving a definite lead over the remainder. There is still some prospect for further gain, as also in the other subjects. Though RED is throughout distinctly slower than BLUE, their absolute gains are so commingled that superiority can scarcely be assigned to either. Both gain about equally at equal rates, though BLUE is more irregular near the beginning, RED near the end. As before in the addition test, the smallest absolute gain is shown by ORANGE, who has here also the lowest level of initial efficiency. Altogether, an association of superior initial performance with greater absolute practice improvement is seen to obtain also in these records.

Unfortunately the individual differences in this test among the women subjects turn out so small that not much light on the question at issue is to be derived from the records. So far as they go, however, they do not exhibit the parallel between absolute gain and initial efficiency of which the previous records have shown such marked instances. A strikingly anomalous record is given by RED', who, beginning at the highest initial efficiency, shows considerable drop in the practice curve, to fourth place; which is never improved upon. The absolute gain is, of course, much the smallest of any. This is the more noteworthy in connection with the very great practice effect of this subject in the addition test. The absolute gains of the other four subjects are much commingled, though BLUE' has rather the most; in point of initial efficiency this subject stands fourth. Next come ORANGE' and GREEN', whose gains are practically equal, as are also their initial positions, though ORANGE', with the slightly inferior initial position, seems to gain a little more. As in the addition test, BROWN' shows the lowest efficiency throughout, and the smallest absolute gain with the exception of RED'; but on the whole, the greater absolute gains have not here been associated with greater efficiency of initial performance.

Nor would the number of observations be sufficient to establish a universal principle, even were they in general accord. Definite things do; however, stand out in regard to certain individual records. It is patent from such cases as BLUE and BLUE' in the addition test and BROWN in the number-checking test, that high initial efficiency in no way precludes, but on the other hand, may frequently indicate, the expectation of considerable practice improvement. On the other hand, ORANGE and BROWN' are examples of slight susceptibility to absolute gain, apt to be associated with lower efficiency of performance. It is not apparent that such records



PLATE I. Absolute Gains in the Addition Test, Men.

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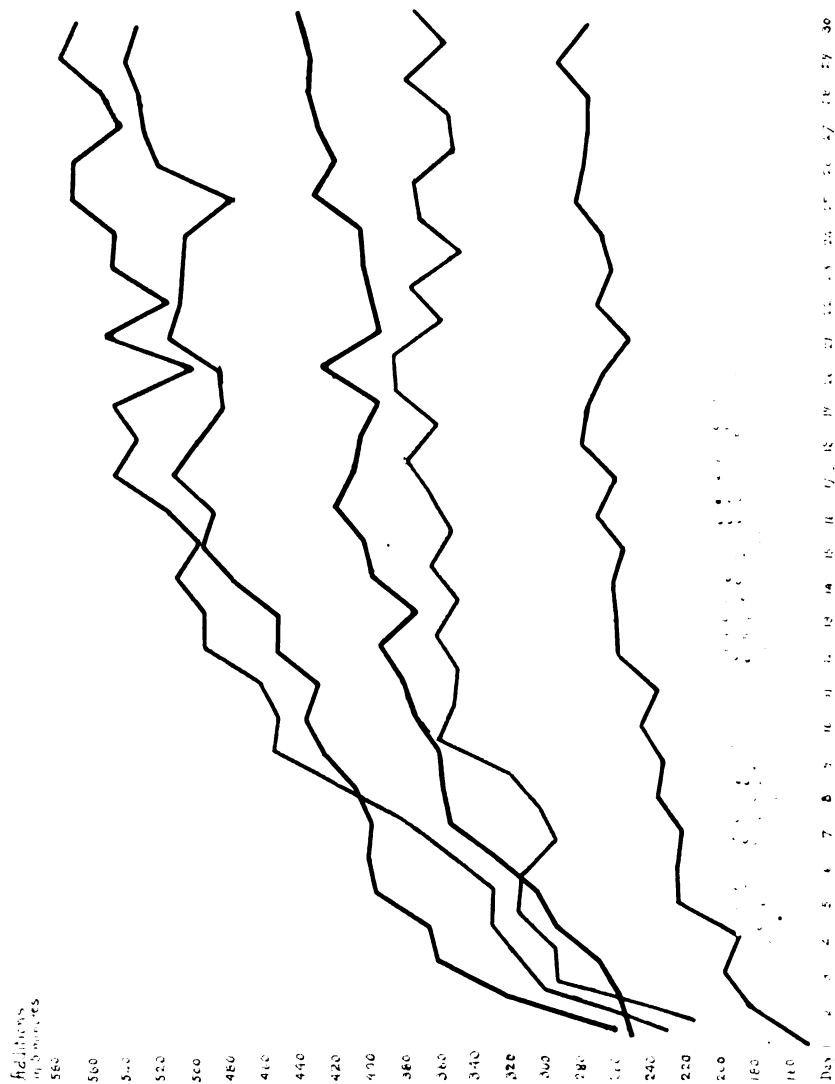


PLATE II. Absolute Gains in the Addition Test, Women.

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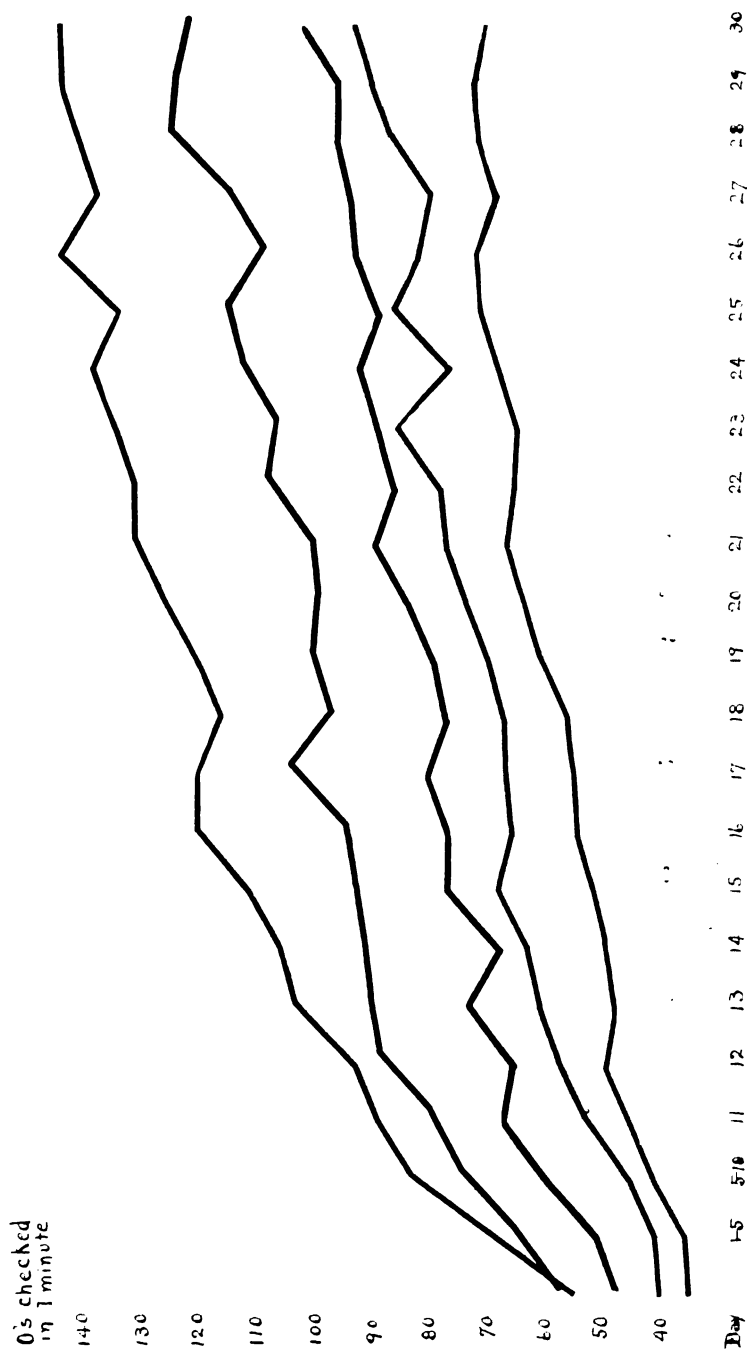


PLATE III. Absolute Gains in the Number-Checking Test, Men.

12345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989910010110210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913001301130213031304130513061307130813091310131113121313131413151316131713181319132013211322132313241325132613271328132913301331133213331334133513361337133813391340134113421343134413451346134713481349135013511352135313541355135613571358135913601361136213631364136513661367136813691370137113721373137413751376137713781379138013811382138313841385138613871388138913901391139213931394139513961397139813991400140114021403140414051406140714081409141014111412141314141415141614171418141914201421142214231424142514261427142814291430143114321433143414351436143714381439144014411442144314441445144614471448144914501451145214531454145514561457145814591460146114621463146414651466146714681469147014711472147314741475147614771478147914801481148214831484148514861487148814891490149114921493149414951496149714981499150015011502150315041505150615071508150915101511151215131514151515161517151815191520152115221523152415251526152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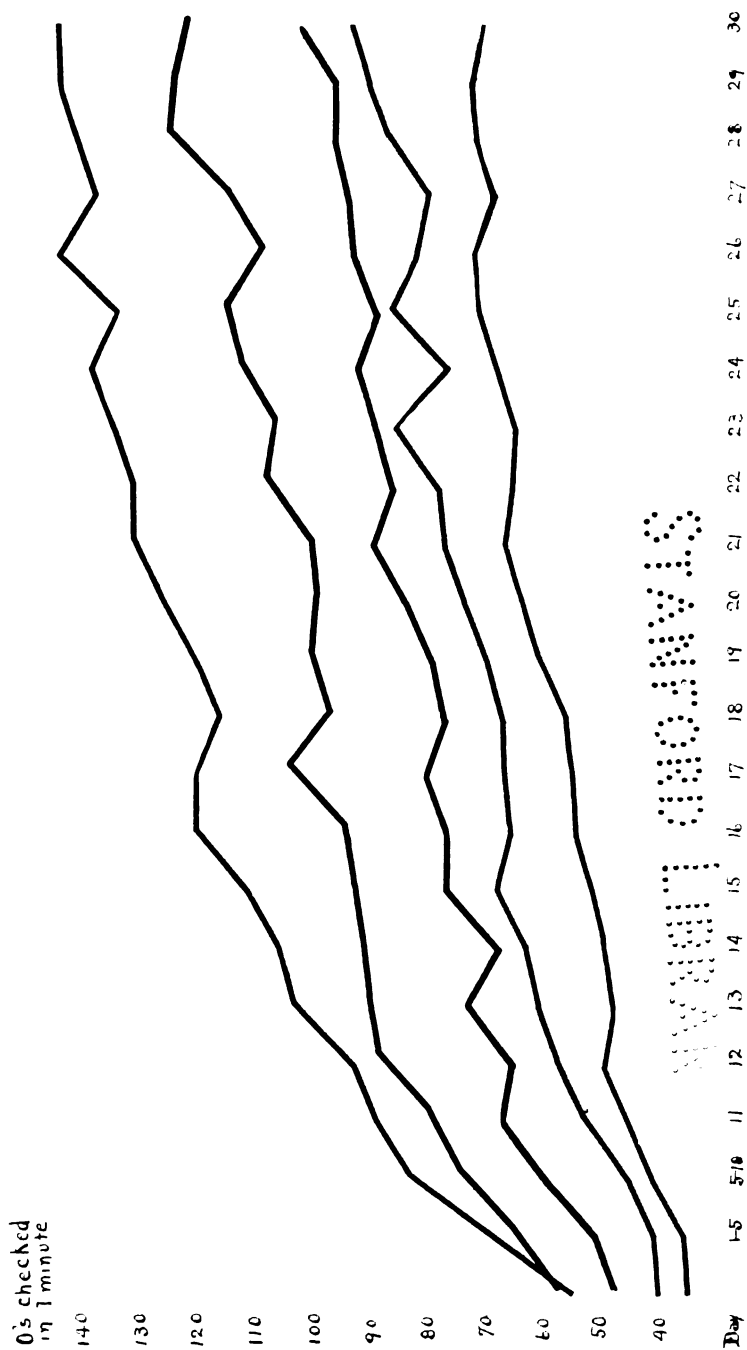


PLATE III. Absolute Gains in the Number-Checking Test, Men.

STANDARD

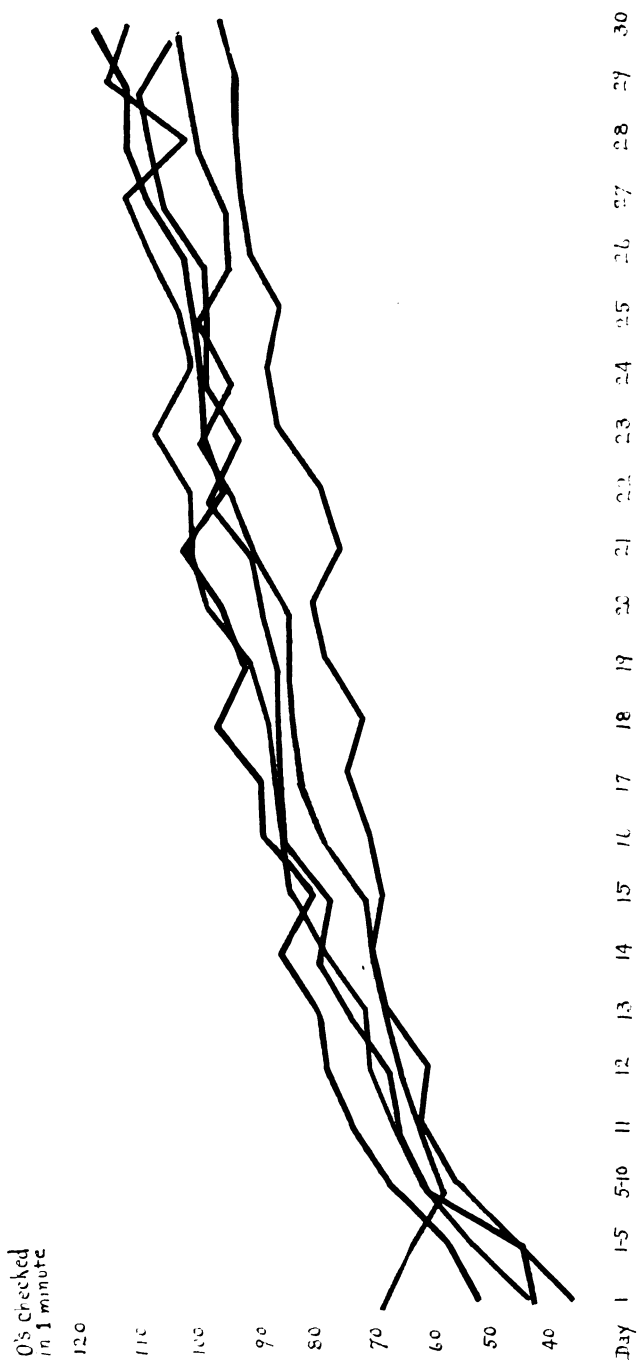


PLATE IV. Absolute Gains in the Number-Checking Test, Women.

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represent the end of the practice curve for the subject concerned. We are evidently confronted, then, with cases indicating a high initial efficiency as a manifestation of superior ability to profit by practice, or plasticity; and on the other hand, with cases exhibiting a lower initial efficiency, with minor possibilities of practice improvement.

As has been explained, the curve for the relative gains reduces the results for the different subjects to a common denominator, taking the initial performance in each case as 100, and expressing the subsequent ones in their percentile relation to it. The curves in each case thus start at the same point. As would naturally be expected, the relative amounts of ascent differ largely from those in the curves for the absolute gains. Thus in the curves showing the relative gains in the addition test for men, it is seen that the greatest relative gain has been made by RED, whose regular position was third in the curves for absolute performance. This subject has reached an efficiency of some 210% of initial capacity. GREEN, somewhat slower absolutely, also does not gain so much relatively; his curve being pretty consistently below that of RED. With their high initial performances, the relative gains of BROWN and BLUE drop still further below; for they require a much greater absolute gain than the others to reach their percentile level. The relative gain of ORANGE is the smallest of all, the inferiority being more marked here than in Plate I, owing to the relatively high initial performance.

The curves showing the relative gains in the addition test for the women are dominated by the striking practice improvement of RED'. But it is noteworthy that BLUE', who had the greatest initial efficiency, is second in point of relative, as well as in absolute gain. BROWN', whose absolute efficiency was lowest, is next, while ORANGE' shows a relative gain distinctly above that of GREEN', though in absolute performance distinctly below it. GREEN', showing the least relative gain, is third in absolute gain, second in initial performance. Here also it is seen that the relative gains tend rather to follow the reverse order of the absolute performance.

But in the case of the men in the number-checking test, it is again noticeable that BROWN, who not only had the quickest record in the number-checking test and made the greatest absolute gain in it, has with equal definiteness accomplished the greatest relative gain. The relative gains in the other records are nearly equal, which should be taken in connection with the fact that the range of these records in gross efficiency of performance is nearly 2:1. Here, then,

there is certainly no negative relation between gross performance and relative gain.

The curves are further apart in the case of the women, and show a reversed relationship to the absolute performances. They are greatest in BROWN', whose absolute efficiency is lowest, and next in ORANGE', BLUE' and GREEN', respectively. But neither in absolute nor relative gains are the individual differences especially clear-cut.

To sum up, the orders of precedence in the different functions of the two tests may be given as follows:

ADDITION TEST (MEN)

Initial Performance	Absolute Gain	Relative Gain
Blue	Blue	Red
Brown	{ Brown }	Green
Orange	{ Red }	Brown
Red	Green	Blue
Green	Orange	Orange

ADDITION TEST (WOMEN)

Initial Performance	Absolute Gain	Relative Gain
Blue'	Red'	Red'
Green'	Blue'	Blue'
Red'	Green'	Brown'
Orange'	Orange'	Orange'
Brown'	Brown'	Green'

NUMBER-CHECKING TEST (MEN)

Initial Performance	Absolute Gain	Relative Gain
Green	Brown	Brown
Brown	Green	Red
Blue	{ Red }	{ Green }
Red	{ Blue }	{ Orange }
Orange	Orange	Blue

NUMBER-CHECKING TEST (WOMEN)

Initial Performance	Absolute Gain	Relative Gain
Red'	Blue'	Brown'
Green'	Orange'	Orange'
Orange'	Green'	Blue'
Blue'	Brown'	Green'
Brown'	Red'	Red'

Certain limitations in the use of either absolute or relative gain as a criterion of practice effect will doubtless have

suggested themselves to the reader familiar with the properties of the practice curve. It is scarcely to be supposed that a practice improvement of n units means the same thing when added to an initial efficiency of a units as when added to an efficiency of $2a$ units. *Ohne weiteres*, however, it should scarcely be said that one is more or less than the other. If, as has been sometimes done, we simply suppose higher initial efficiency to mean that the function is nearer the end of the practice curve, then obviously the gain of n units is more difficult for the individual who has a higher initial efficiency. The present results indicate that this reasoning rests upon a very insecure foundation, for it here repeatedly appears that the gain of n units is quite as likely if not more likely to take place upon an efficiency of $2a$ than of a . Another point must be mentioned in this connection, namely, that when the function is originally measured in terms of amount performed in a given time, as it is in the addition test, the amount of work performed in practice is much greater in the case of the more efficient individuals. Thus when the less efficient A has made as many additions as the more efficient B , he may have improved as much, though taking over twice the time to do it. If this factor were of essential importance, then the low initial efficiencies should, in comparison with the other subjects, show a much greater absolute gain in the number-checking test, where they do equal work, than in the addition test, where they do less work. With the men, this is not at all the case. With the women there is perhaps a little more semblance of it, but on the whole, the number-checking test scarcely seems to have favored the practice of the poorer individuals any more than the addition test. This, with its implication of a law of diminishing returns from individual practice series, leads into the great series of problems regarding the most efficient way to practise. A definite amount of work doubtless produces different practice effects according to different apportionments to the same individual, just as it illustrates different practice effects when, as here, it is similarly apportioned to different individuals.

According to presentation in terms of time or amount, the phenomena of the absolute gain present a curious dilemma. The curves have been plotted in terms of amount performed in a given time, and if the absolute gains of the more efficient individuals are greater than those of the less, the records assume the fan-shape recorded most perfectly in Plate II, the distances between the subjects becoming greater. Now if, instead, the curves were plotted in terms of time, they would

approach each other as they neared the lower limit of quickness, and the distances between the subjects would become less. Compare the cases of a worker, C, making 100 artificial flowers per hour, and one, D, who makes 50 in the same period. With given practice, C becomes able to make 175 per hour, and D able to make 100. The gains compare as follows according to the way they are considered:

C has made an absolute gain of 75 pieces.

D has made an absolute gain of 50 pieces.

C has made a relative gain of 75 per cent.

D has made a relative gain of 100 per cent.

C has decreased the time required for 100 pieces by 26 minutes.

D has decreased the time required for 100 pieces by 60 minutes.

Nevertheless, there can be but little doubt that any manufacturer would consider C as having improved the original lead over D. If for artificial flowers we substitute distance covered in yards, C would certainly be a further distance ahead of D at the second timing than at the first; nor according to the observed properties of the practice curve, would C's lead be likely ever to become less.

And further, since the ratio of gain is not constant in the practice curve, but tends to decrease, the relative gain cannot itself be employed as a criterion of practice effect, though it is similar, whether time or amount is taken as the unit of measurement. If one considers equal percentile changes, no matter what their bases, to represent equal practice effects, one runs counter to our most fundamental conceptions of the nature of the practice curve. One can scarcely require that a function of 600 units shall show 300 units of improvement before it shall be judged to have improved equally to an increase of 50 units from a basis in another individual of 100 units. If a function, x , begins at 600 units and increases to 900, it should certainly be accounted more plastic than an identical function, y , which begins at 100 and in the same time increases to but 150. It is another question whether y should be accounted more plastic than x , which begins at 500 units and rises under the given conditions to 550. If y reaches the 500 mark it will not, presumably, be able to reach 550 as quickly as it did 150 from the 100 mark, therefore, not so quickly as x increased from 500 to 550. On the other hand, y has already increased in capacity by 50%, which x is not likely ever to do now. It would depend upon whether x 's advanced position were

to be regarded as constitutional, or due to an advanced position in the practice curve. If the constitutional ability of *x* began at or near that of *y*, it must be reckoned as more plastic; if it is fairly represented by the 500 unit mark, it is obviously less so.

But of course we cannot know objectively, from any isolated or initial performance, what part of the function's practice curve it represents. This we must know, to judge of the amount of plasticity represented by a given practice gain. From the form of the actual practice curves we must judge whether there are sufficient differences in the stages of practice to modify the interpretations of the gains accordingly. Except where such differences are indicated, and they scarcely seem to be in the present results, there would seem to be two criteria of greater plasticity. First, a greater absolute gain, in terms of amount, upon a basis of greater initial performance. Secondly, a greater relative gain leading to a greater efficiency of terminal performance.

According to these criteria, the records show various instances of individual differences in capacity apparently the result of differences in the fundamental plasticity of the function. The inferior showing of ORANGE in the number-checking test, for example, is essentially due to something other than mere lack of practice, for in such a case the relative gains would but have been so much the greater, as they were in RED' for the addition test. On the other hand, the performance of BLUE' in the addition test is not a matter of starting nearer the end of the practice curve, for not only has she a better initial performance, but gains more, both absolutely and relatively, than BROWN', ORANGE' or GREEN'. Her superior initial performance is to be looked upon rather as a matter of fundamentally superior aptitude in the function,¹ which continues to manifest itself in greater practice improvement. The same is to be said of the record of BROWN in the number-checking test. The superior aptitude expresses itself in both superior actual performance and superior ability to profit by practice. Or when the record of ORANGE in the addition test is compared with that of BLUE, it is seen that ORANGE starts not only distinctly below the absolute level of BLUE, but fails to gain absolutely or even relatively as much. Here the function in ORANGE is certainly less plastic.

Ultimately that individual is the most plastic who is able

¹In this connection, the reader may be reminded of the especially good adaptation of this subject in the free association test. *Am. J. of Psych.* XXII, Plate facing p. 2.

to improve the most. If we may reckon the original ability in the function as approximating zero, as it may be considered to do at birth, then the individual who stood higher at the beginning of special practice would be the individual who had, up to that time, improved more. This previous improvement might carry with it less, might carry with it greater prospect of future improvement; the present experiments seem to indicate that it carries with it the prospect of greater future improvement more frequently than less. But the different exceptions show that we ought in no wise to consider the plasticity of a function as always the determining factor in its efficiency at the beginning of special practice; the case of ORANGE in the addition test may be quoted in illustration. It thus seems likely that certain factors of neural constitution, independent of plasticity, may determine high or low efficiency at the beginning of special practice. This is what is meant by the "constitutional" factors in ability as cited above; and though undeniably complicating the situation, they seem a necessary postulate to its proper formulation.

We have then, finally, (1) a difference in the individual's (*resp.* function's) fundamental plasticity, i. e., ability to profit by practice, (2) a difference in the actual amount of practice experienced, and (3) constitutional factors, independent of plasticity, in the nervous system. The inquiry has been concerned with the relative importance of these factors in producing the individual differences seen at the beginning of special practice. In the present instances, their influences would seem to operate in about the order named.

Further points of inquiry concern the results as they illustrate other important properties of the ability to improve by practice. To what extent does it seem to be a fundamental attribute of the individual, or distributed independently among various special functions? The performance of RED' is an illustration of extreme plasticity in one test combined with an equally striking lack of it in the other. The gain of BROWN in the number-checking test is quite out of proportion to that in the addition test. On the other hand, ORANGE and BROWN' seem to furnish instances of a lack of plasticity in both tests; for BROWN', though making the greatest relative gain in the number-checking test, in neither case gains sufficiently to leave a fairly definite lowest place. How far such a presence or lack of plasticity might be general, the experiments, of course, do not indicate; but it seems quite certain that the degree of plasticity is sometimes determined with regard to the special function.

An additional point concerns the daily fluctuations in the practice curves after they have ceased their uniform rise. Like other practice curves, the daily records in both tests are serrated; going now up, now down. The causes of such episodes in the curve might be general, affecting the whole organism, or confined to the particular functions involved. Some estimate of the extent to which general or special causes are involved might be derived through comparing the curves of the two tests, noting whether there tended to be a coincidence of marked cusps in the curves.

The testimony of the curves in this regard is quite unequivocal. If one superposes the two curves of each subject for the last twenty days of performance, it is evident that the curves rise and fall with practical independence of each other. Extreme rises or falls in one may be accompanied by rises, falls or no change in the other function. This is interesting in connection with the fact that such introspective data as were given seemed to be equally independent of the performance in either test; nor did the subjective estimate of efficiency always accord with that actually attained. The performance in the two tests would seem to be determined by factors largely outside the scope of introspection; and the organic processes giving rise to a feeling of unfitness for the task must be of considerable intensity to show an actually unfavorable effect upon its performance. While it is not necessarily true that a general change in bodily condition would affect both tests in the same direction, yet the comparative independence of their fluctuations makes it extremely probable that different factors of bodily condition are operative upon them, and throws an interesting side-light upon the complexity of the factors affecting the performance in two by no means unrelated experiments.

The groups of subjects are perhaps too small to expect any special sex differences to be illustrated. Even though consistent differences between such groups appear, they may often be the result of chance. In the addition test the performance of the women is much more variable than that of the men, in the number-checking test it is much less so. In neither case is there much difference in the average performance. More significant perhaps is the question of a sex difference in susceptibility to practice. In the addition test the balance is about equal; and in the number-checking test, the variability of the records makes any generalization hazardous. A far-reaching sex-difference in susceptibility to practice seems, so far as concerns the functions covered by these experiments, quite improbable.

The secondary findings in these experiments may then be enumerated as (1) the specific character of efficiency in the tests themselves, (2) the specific character of plasticity in them, (3) the specific character of such episodic changes in the organism as influence their efficiency, and (4) the absence of any notable sex-difference throughout.

The more significant result would seem to be the indication that a superior performance at the beginning of special practice is not necessarily, nor even probably, attained at the sacrifice of prospects for future improvement. A high initial efficiency may carry with it as much or more prospect of improvement under special practice than a low one. It was not because the favored individual had had more of the general experience enabling him to meet the experimental situation better, but because he possessed the native ability to profit more by such experience, general and special, past and future. Not practice, but *practiceability*, is responsible for the superior position of such an individual; and, in broader aspect, not education, but educability.

The present results seem then to be another drop in the current that sets towards the interpretation of vital reactions as primarily limited and determined by factors of original nature, upon which a more incidental coloring is imposed by those of experience and environment.

THE INFLUENCE OF CAFFEIN ALKALOID ON THE QUALITY AND AMOUNT OF SLEEP

By H. L. HOLLINGWORTH, Columbia University

The data presented here were accumulated during an elaborate series of experiments undertaken with the following five chief purposes in mind.

1. To determine both qualitatively and quantitatively the effect of caffein on a wide range of mental and motor processes by studying the performance of a considerable number of individuals for a long period of time under controlled conditions.

2. To study the way in which this influence is modified by such factors as the age, sex, weight, idiosyncrasy and previous caffein habits of the subjects, and the degree to which it depends on the amount of the dose and the time and conditions of its administration.

3. To investigate the influence of caffein on the general health, on the quality and amount of sleep, and on the food habits of the individuals tested.

4. To inquire into the value and adaptability of a considerable array of simple tests, with a view to their standardization for the purposes of pharmaco-dynamic research.

5. To accumulate data on the effects of practice, fatigue, diurnal variations in efficiency, the physiological limit, individual and sex differences, and various other allied topics growing out of such an extended series of tests on a large number of subjects.

PLAN AND PROCEDURE

In order to reduce to a minimum distractions and disturbances to which such experiments are usually subjected and to provide for the greatest convenience of the experimenters and the comfort of the subjects, a well lighted and ventilated six-room apartment on the ground floor of a building in a quiet part of the city was equipped as a special laboratory. Sixteen subjects, ten men and six women, were engaged for full time for a period of 40 days, and were required to appear at the laboratory at stated times during the day or

to remain there permanently, as the case might be, and submit themselves to the series of mental and motor tests. These subjects were to abstain from the use of all forms of caffeine (coffee, tea, chocolate, cocoa), alcohol, nicotine and all other drugs, as well as from soda fountain drinks containing patent syrups, except in so far as these drugs were prescribed by the director or by the medical assistant. They were also to observe regular hours of eating and sleeping, and to report any unavoidable irregularities in these matters. These conditions were complied with throughout the experiment.

The present study is a report on the second point of the third chief topic. Reports on other topics are ready for publication, and may be expected to appear soon in accessible sources.

THE INFLUENCE OF CAFFEIN ON SLEEP

Throughout the experiment each subject kept daily records of his general condition of health and spirits throughout the day, indicating in his special "daily health book" any signs of bodily distress or discomfort, such special or general organic, digestive and nervous disturbances as might be noted from time to time, and in general as good an introspective account as possible of his mood and tonus. In addition to stating the character of any symptoms or unusual observations, the time of their appearance and their duration were noted and reference made to any outside factor which might have been responsible for the condition described. This health record was divided into two parts, the first having to do with the day-time hours preceding the evening on which the entry was made, and the second having to do with the night-hours following. This second entry was made on the following morning, immediately on arrival at the laboratory. At this time each individual recorded the approximate number of hours which he had slept during the night and described the quality of his sleep as "better than usual," "ordinary," or "worse than usual." In working up these data the approximate number of hours was accepted as stated. From the point of view of character or quality, an attempt was also made to express the effect of caffeine in numerical form. Representing the individual's *usual* quality of sleep by a value of 200; letting the value 100 indicate sleep which, according to the judgment of the individual himself, was *better than usual*; and letting the value 300 represent the quality of sleep which the individual himself judged to be *worse than usual*, tables were compiled from the introspective records

occurring in the daily health books. In the individual averages then as well as in the squad averages, a value of 200 indicates normal sleep; all values less than 200 indicate sleep judged unusually good; while all values larger than 200 indicate impaired sleep.

It will be recognized at once that these measures of sleep quality are only rough and approximate, but it is just as obvious that they are as accurate measurements of the thing in question as can well be secured. The individual himself is the only one who knows anything about his customary sleep quality. In daily life we pass such judgments as those given in the present experiment, and in much the same way, with about the same number of categories. We pronounce ourselves to have slept "well" or "poorly" or "about as usual." Finer distinctions would probably have little or at most exceedingly variable meaning. With respect to the criteria on which such judgments are based there are also considerable individual differences. The number of hours slept through, the number and character of the dreams, the interval after retiring before sleep ensued, the number of times awakened during the night, general feelings of relief or languor after arising, etc., all play their part, no doubt. And the judgment is at best only a secondary one,—that is to say, the quality of sleep is inferred from introspections and observations made during waking moments. In spite of this, few judgments of this subjective character would seem to have higher reliability than the individual's own opinion of the satisfactoriness of his slumber, and when the categories are limited to the three employed here, the judgments are delivered with a high degree of confidence. The reliability of the judgments is moreover emphasized by the consistent conclusions suggested by the various tables.

The statements of number of hours' sleep are at best only approximate, in cases of impaired sleep. When the slumber was not disturbed the figures are more reliable, since all the subjects observed regular hours of retiring and arising. It will not be possible here to compare the individual subjects nor the squad averages with each other, except in so far as the number of hours' sleep on control days is adopted as the normal in each case. A fairly constant average of about 7.5 hours' sleep appears to be the normal for all of the subjects, as is indicated by the records for the week before the caffeine doses began, and also by the records for the control days during the caffeine experiments.

The records on sleep fall into two general sections, the

first covering 28 days of caffein alkaloid experiments, and the second covering 7 days of experiments with syrups and carbonated water, with and without caffein contents. In the following tables the first column gives the averages for the first week, during which only sugar doses were given to all subjects. The second column gives the averages for the control days during the following three weeks. These two columns may then both be considered as normals. The third column gives the averages for the days on which the dose was either 1 or 2 gr. of caffein, the fourth column the records for the 3 to 4 grain doses, and the fifth column for the 6 gr. doses. The last column gives the final average for all the caffein days (1 to 6 gr. doses). The individual subjects are grouped in squads according to the time at which the dose was taken and according to the distribution of the doses during the month.

X Squad I, consisting of subjects 1, 4, 7, and 15, were the control squad, and ran throughout the four weeks on sugar doses only. Nevertheless their records have been averaged as though they had taken the caffein on alternating days, as was the case with squads III and IV. The parenthesis around their averages indicates then that these were not really caffein days, but days on which the caffein squads took the doses indicated at the top of the various columns. The sleep records of the individuals taking caffein may thus be compared with the control records of individuals taking only sugar on the corresponding days. The caffein records are thus trebly checked up,—first by a normal week for all subjects, second by control days for all subjects during the following three weeks, and thirdly by a control squad running throughout the month on sugar doses only.

Squad II, consisting of subjects 8, 12 and 13, took caffein on three days and sugar on the following three days at 10:30 A. M., followed in turn by three days of caffein, and so on throughout the experiment, except that there was only one day available for the 6 grain dose. The 1 to 2 grain records for this squad are the averages of 3 days of 1 grain and 3 days of 2 grain doses. The records for 3 to 4 grains are the averages of three 4 grain days, while the records for 6 grains are not averages but single records.

Squad III took caffein and sugar doses on alternate days throughout the experiment, at the 1 o'clock lunch hour, thus giving two days for each of the 1, 2, 3, 4 and 6 grain doses. Squad IV also alternated caffein with sugar doses throughout

the month, with the same distribution of days as in the case of squad III, the only difference being that the dose was taken in the middle of the afternoon instead of at the lunch hour. Squad III consisted of subjects 3, 9 and 14, while squad IV contained subjects 5, 6, 10, 11 and 16.

Experiments with Caffein Alkaloid

Table I gives the individual averages for quality of sleep during the first four weeks, and also the squad averages, with final averages for the caffein days and a grand average for each column for the three caffein squads.

TABLE I. INFLUENCE OF CAFFEIN ALKALOID ON THE QUALITY OF SLEEP

Squad.	Subjects	First Week	Control Days	CAFFEIN DOSES			Caffein Average
				1 to 2 gr.	3 to 4 gr.	6 gr.	
I Sugar only	1	180	190	(225)	(200)	(150)	(200)
	4	200	230	(200)	(200)	(300)	(220)
	7	170	150	(175)	(125)	(100)	(140)
	15	200	230	(225)	(200)	(250)	(220)
Average		187	200	(206)	(181)	(200)	(195)
II Morning Caffein 3 days Sugar 3 days	8	220	220	250	266	300	273
	12	200	210	200	200	300	233
	13	220	190	200	200	200	200
	Average	213	207	216	220	266	234
III With lunch Alternately	3	200	240	275	200	200	225
	9	220	190	225	200	250	225
	14	200	230	200	175	200	191
	Average	213	220	233	192	217	214
IV Mid P. m. Alternately	5	230	200	250	250	300	266
	6	200	190	175	175	250	200
	10	220	210	175	225	300	233
	11	200	210	250	250	200	233
	16	150	140	150	150	300	200
Average		200	190	200	210	270	226
Grand averages of Squads II, III and IV		208	206	216	207	251	224

Table II brings together the averages for each squad, at the same time giving the mean variation of each average and the number of cases from which the average is in each case derived. The table also gives the final averages for the three caffein squads, the mean variation of the three squad averages from this final average, and the total number of cases for each kind of dose. The number of cases depends chiefly on the number of individuals making up the squad,

and in the case of squad II on the fact that 3 grain doses were not administered and that only one 6 grain dose was given.

TABLE II. THE SQUAD AVERAGES FOR CAFFEIN ALKALOID

<i>Squad</i>	<i>First Week</i>	<i>Control Days</i>	<i>1 to 2 gr.</i>	<i>3 to 4 gr.</i>	<i>6 gr.</i>
I	Av. 187	200	(206)	(181)	...
Sugar only	M. V. 47	35	35	30	...
	Cases 24	28	16	16	...
II					
Caffein 3 days	Av. 213	207	216	220	266
Sugar 3 days	M. V. 40	31	27	33	44
10.30 A. M.	Cases 18	30	18	9	3
III					
With lunch on	Av. 213	220	233	192	217
alternate days	M. V. 31	40	50	15	72
	Cases 18	30	12	12	6
IV					
mid P. M.	Av. 200	190	200	210	270
alternate days	M. V. 33	49	50	30	39
	Cases 30	50	20	20	9
Final Averages	Av. 208	206	216	207	251
of caffeine	M. V. 6	10	11	10	23
squads	Total				
	Cases... 66	110	50	41	18

The data presented in the two preceding tables seem to justify the following conclusions concerning the influence of caffeine alkaloid, taken in its pure form, on the quality of sleep.

1. Doses smaller than 6 grains do not cause impairment of sleep, so far as the squad averages indicate. The average M. V. of these squad averages is 38. Although the figures for squad II are larger for all doses of caffeine the range is quite within the probable error except for the 6 grain doses where sleeplessness is clearly present (Table II). Squad III shows no sleep impairment whatever, the quality being reported even quite uniformly better on caffeine days. Squad IV similarly shows no deterioration in sleep quality until the 6 grain dose is reached, but the falling off at this point (270) is apparent. The final averages of the caffeine squads show the rule clearly. Up to the 4 grain doses the sleep quality remains quite constantly about 209, but at 6 grains there is an abrupt falling off to 251 (Table II). Since these figures are the averages of 11 individuals, with daily records covering a period of 28 days, they have high reliability.

2. The influence of the caffeine dose depends to a quite appreciable degree on the conditions under which the dose is taken, and especially on the time of day, the contents of the stomach at the time, and the frequency with which the dose is taken. This dependence is indicated by a comparison of the averages for squads II, III and IV.

a. The greatest impairment of sleep quality is found in the case of those taking the doses on successive days (Av. 234), and this is true in spite of the fact that the dose was in these cases taken early in the morning, some four hours before squad IV and two to two-and-a-half hours before squad III. Had the dose been taken later in the day the difference would doubtless have been still greater. It is impossible to say, on the basis of the data at hand, how soon this cumulative effect would be compensated by such processes of adaptation as are well recognized features of drug action.

b. Next to this squad, the greatest sleep impairment is found with the group (Squad IV) taking the caffein dose late in the afternoon, between meals and on an empty stomach (Av. 226).

c. Quite in line with this fact is the further evidence that when the dose is taken along with food substance, as in the case of squad III who took the caffein at the lunch hour, there is absolutely no evidence of sleeplessness. The presence of food substance in the stomach seems not only to retard the action of the drug but to weaken or even completely neutralize its effect, so that the average for squad III (214) is actually better than their own average on control days (220), although this difference, since it is quite within the probable error, is not evidence of genuine superior quality. The lowest value for this squad is at the 1-2 grain doses (233) but this large figure is due solely to the one individual (subject 3, Table I) who reported poor sleep for several nights in succession,—on control days (240) as well as on caffein days.

3. These results are confirmed by a more detailed study of the records of the individuals making up the various squads. Three subjects, 3, 13 and 14 are not affected even by the maximal 6 grain dose. Five remain unaffected until the 6 grain dose is reached, these being subjects 6, 9, 10, 12 and 16. Only three individuals of the total eleven show signs of disturbance before the 6 grain dose is reached,—these being 5 and 8 (who report sleeplessness as soon as the caffein doses begin and show increasing impairment with larger doses) and 11 who reports 250 for 1-2 and for 3-4 grains but did not seem to be disturbed by the 6 grains.

4. The age of the individual, within the limits here reported, —21 to 39 yrs.,—does not seem to influence his susceptibility to the sleep-disturbing effects of caffein. The three individuals who report poor sleep after the minimal doses are 24, 27 and 33 years of age, respectively, averaging 28 years.

The five who were disturbed only by the 6 grains range from 21 to 33 years, averaging 26. The three who are not affected at all are 22, 27 and 39 years old, averaging 29.3 years. The figures thus show no correlation between age and the ease or degree of sleep-disturbance. (See Table III.)

5. Previous caffeine habits do not seem to modify the individuals' susceptibility during the experiment. Table III indicates for each subject the coffee or tea drinking habits indulged in before the experiments began, and reveals no uniformity. Individuals who were accustomed to the regular use of caffeine-containing beverages are to be found in each group along with those who have never used coffee nor tea, or have used them only occasionally.

6. So far as the present experiment is concerned, no sex differences in susceptibility are disclosed. Four of the subjects in the caffeine squads were women. Of these two were affected by minimal doses, one by maximal doses only, and one not at all. Of the men, two were not affected at all, four were affected by the maximal dose only, and one by the minimal.

7. The only factor which correlates closely with susceptibility is weight. Table III shows this correlation clearly. The average weight of those who are affected by the minimal doses is only 120 pounds. The average weight of those who are affected, but only by the maximal dose, is 149 pounds, while the average weight of the three individuals who are not affected at all is 176 pounds. That is to say,—the greater the body weight of the individual the greater the immunity to the sleep-disturbing influence of caffeine. The two slightest subjects, 5 and 11, are in the susceptible group, while the heaviest woman and the two heaviest men are in the immune group. The relation between body-weight and the action of drugs in a medicinal way is a well-recognized principle of pharmacology; and it is interesting to find such close confirmation of the principle in these introspective sleep records. It means simply that, when a fixed dose is administered, the heavy or large individual receives relatively a smaller dose per unit of tissue, and the influence of the drug is correspondingly reduced. Age and sex differences in susceptibility to drugs are probably in many cases not true age or sex differences, but differences based on variations in weight or size. A given amount of caffeine, for instance, should be expected to produce greater sleep disturbances in a child than in an adult, not so much because of the child's immaturity as

because of the fact that he receives a larger dose per unit of tissue.

Table III presents the classification of the eleven caffein subjects according to their susceptibility, giving at the same time their age, weight and caffein habit.

TABLE III. INDIVIDUAL DIFFERENCES IN SUSCEPTIBILITY

Type	Subject	Age	Weight	Caffein Habit
1. Reacted to minimal Doses	8	24	144	Used regularly
	5	33	105	Used regularly
	11	27	110	Abstainer
	Average.....	28	120	
2. Reacted to maximum doses only	12	24	160	Used regularly
	9	21	130	Abstainer
	6	33	125	Used regularly
	10	28	157	Occasionally
	16	24	174	Used regularly
	Average.....	26	140	
3. No reaction	13	22	175	Used regularly
	3	30	150	Abstainer
	14	27	193	Occasionally
	Average.....	20.3	176	

TABLE IV. EFFECT OF CAFFEIN ON AMOUNT OF SLEEP

Squad	1st Week	Control	1 to 2 gr.	3 to 4 gr.	6 gr.	Caffein Average
I. Sugar only.....	7.45	7.40	(7.50)	(7.75)	(7.67)	(7.55)
II. Three day periods.....	7.13	7.03	7.46	7.57	7.07	7.37
III. With lunch.....	7.43	7.47	7.57	7.33	6.40	6.90
IV. Mid P. M.....	7.20	7.46	7.38	7.00	6.30	6.88
Average of Squads II, III and IV—Caffein.....	7.25	7.52	7.47	7.30	6.50	7.05

Table IV gives the squad averages of the approximate number of hours' sleep, as well as the final average for the three caffein squads. The figures indicate hours and decimal parts of an hour. The indications here thoroughly bear out the conclusions based on the judgments of sleep quality. The control squad (I) shows little variation as the experiment proceeds, the average amount of sleep being uniformly about 7.5 hours. Squad II, taking caffein in the morning, proceeds in much the same way until the 6 grain dose is given, when the time drops to about 7 hours,—a loss of half an hour sleep. The amount of sleep for squad III, taking dose with lunch, does not diminish appreciably until the 6 grain dose is given, when the earlier average of 7.4 hours abruptly drops to 6.4 hours,—a loss of one hour. The figures for squad IV, taking dose in the afternoon, between meals, drops off .5 hour at the 3 to 4 grain doses, and still another .5

hour at the 6 grain dose. Comparing the caffein average with the control average, squads III and IV lose on the whole, for 1 to 6 grain doses, .6 of an hour. While squad II averages, for the whole range of doses, a loss of only .3 of an hour. The grand average of the caffein squads shows a slight tendency to fall off for the small doses, with an abrupt loss of .7 of an hour at the 6 grain dose; while the grand average for the total range of doses (1 to 6 grains) shows a loss of half an hour, the figure falling from 7.5 hours on control days to 7.0 hours. The individual records show nothing new, and are consequently not published here.

*Influence of Syrups, with and without Caffein, on the
Quality of Sleep*

This experiment covered one week. On two days, no dose at all was given; and on two days, soda fountain syrup containing no caffein was served with carbonated water. On the remaining three days, which were, however, scattered throughout the week, varying amounts of the syrup were given, served with the carbonated water as before, but containing caffein alkaloid (1.2 grains per glass). On one day, 1 glass was taken; on another, 3 glasses; and on the third day, 5 glasses. In all cases the drink was taken in the middle of the afternoon. When the large amounts were taken the drinks were distributed over a period of 2 or 2.5 hours. When the small amounts were taken, the three o'clock hour was chosen for the drink. In this experiment, 12 subjects were used, all of whom had taken part in the previous experiment. No squad division was made. The days on which no dose was taken (called "blank days" in the table), served as control days for the whole group.

Representing as before, the *normal* quality of sleep by the value 200, letting 100 represent sleep introspectively judged as *better than usual*, and 300 sleep judged as *worse than usual*, the following table results from the week's experiment on the 12 subjects. The figure for "blank days" is thus an average of 12 records on each of 2 days,—an average of 24 cases. The figure for "syrup days" is an average, in the same

TABLE V. INFLUENCE OF SYRUPS, WITH AND WITHOUT CAFFEIN.

Character of the dose	SLEEP QUALITY		HOURS SLEEP	
	Average	M. V.	Average	
Blank days.....	179	54	7.48	
Plain syrup, with carbonated water.....	208	23	7.60	
Syrup, with caffein—				
1 glass (1.2 gr.).....	180	30	7.42	
3 glasses (3.6 gr.).....	200	49	7.16	
5 glasses (6.0 gr.).....	250	60	6.75	
Syrup, with caffein, average.....	213	46	7.11	

way, of 24 cases; while each of the "cafein" figures is an average of 12 records.

The results of this experiment completely confirm the conclusions presented in the first section. The "blank days" have a good average quality (179), but no better than that for the day on which the dose consisted of one glass of syrup containing 1.2 grains of cafein. The 3.6 grain dose of cafein results in a poorer quality of sleep than that on the "blank days," but no poorer than that reported on the days on which the same amount of plain syrup was taken (3.6 gr. cafein, 209; plain syrup, 208). Moreover both these figures are approximately ordinary sleep (200). But on the days on which the drink contained 6 grains of cafein there is clear evidence of sleep impairment (250). This is just the point at which the doses of pure cafein alkaloid produced marked signs of sleep disturbance. The average for the three cafein days (1 to 6 gr.) is poorer than that for the plain syrup days (cafein 213, syrup 208), while the average for "blank days" is better than either of these two (179).

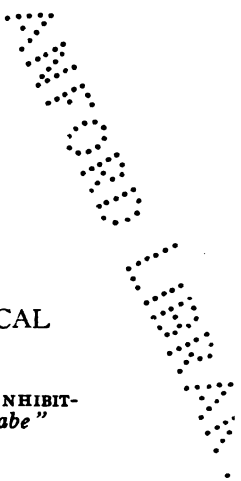
The reports of approximate amount of sleep point in the same direction. The "blank days," the plain syrup days and the 1.2 gr. cafein day all yield the well-established normal of about 7.5 hours of sleep. The average after the 3.6 gr. cafein dose appears to be only slightly less, being 7.16, a loss of about .25 hour. But after the 6 grain dose there is an abrupt falling off, the average being only 6.75 hours, a loss of .75 hour as compared with the normal amount. Not only in their relative amounts, but in absolute magnitude as well, the figures for sleep quality and for amount of sleep, in this second section, correspond closely to the figures yielded by the experiments reported in the preceding section on the effects of pure cafein doses.

It should be remarked that in no case did the subjects know the nature of the dose which they were taking at the time. The only indications they had throughout the experiment were based on the after-effects of the drug. In *Section 1*, each subject received a capsule daily, this capsule sometimes containing cafein in amount known only to the director of the experiment, and at other times only sugar of milk. The control capsules were varied in size, as were, of necessity, the cafein capsules. In *Section 2*, the subjects knew only that they were taking soda-fountain drinks. There was said to be a slight variation in the taste from time to time; but this was supposed, by the subjects, to be due to the degree to which the syrup had been mixed with the carbonated water,

to its temperature, etc. The disturbing factors of suggestion, interest, excitement and unequal introspective attention were thus effectually avoided.

SUMMARY

By way of summary we may say,—Small doses of caffeine alkaloid (1 to 4 grains), taken either in the pure form or accompanied by small amounts of syrup, do not produce appreciable sleep disturbance except in a few individual cases. Doses larger than these (6 grains, in the present experiment), induce marked sleep impairment with most subjects, though even here a few individuals show complete resistance to its effects. The effects are greatest when the dose is taken on an empty stomach or without food substance, and when it is taken on successive days, so as to permit of cumulative effect. The effect of the drug does not seem to depend on the age, sex, or previous caffeine habits of the individual, but varies inversely with increase in body weight. These conclusions hold both for the quality and for the amount of sleep.



MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF VASSAR COLLEGE

XVIII. MEDIATE ASSOCIATIONS STUDIED BY THE METHOD OF INHIBITING ASSOCIATIONS: AN INSTANCE OF THE EFFECT OF "*Aufgabe*"

By M. VALERIE ATHERTON and M. F. WASHBURN

The term "mediate association" is one whose meaning seems to be differently apprehended by different writers. Titchener, in his recently published Textbook of Psychology, writes as follows: "Some psychologists believe that an association may be set up, originated, by unconscious (purely physiological) intermediaries. I examine a picture, we will say, which the artist has signed; my eyes travel over the signature, but I fail entirely to remark it. At some later time I am examining another picture, signed in the same way by the same artist; again my eyes travel over the signature, but again I fail to remark it. Nevertheless, the second picture suggests the first; the signature has impressed my brain, although it has not aroused a perception; the ideas of the two pictures are connected by this unconscious link. Here is a case of mediate association." This form of association Titchener thinks does not occur: "association requires attention." (*Op. cit.* p. 386).

Evidently what Titchener understands by mediate association is a case where the link (the artist's signature) which connects the two experiences (the two pictures) has never, at any time, been in focal consciousness. The observer failed altogether to remark the artist's signature when it was originally presented to his sense of sight. Now an examination of the methods used by some of the investigators of mediate association will show that they could not possibly have understood the term in this sense. When Münsterberg,¹ for instance, presented two different words on two different occasions, with the same nonsense syllable accompanying them, in order to see whether the second word would suggest the first, he surely did not expect that the observer would not notice the nonsense syllable at all on either occasion. When Cordes² gave as the common *Nebenreiz* accompanying two words a tone, a perfume, or a weak electrical stimulus, he certainly did not suppose that the *Nebenreiz* would be unperceived or unattended to: he meant only to find whether it could constitute a link between the two words without being recognized as such. When Aschaffenburg³ quotes as illustrations of the mediate associations he encountered in his experiments, such cases as the following: "Schnitt (Schlitten), Fahrt; Allmacht (alma), Mater," he did not for a moment think that the intermediate links

¹ H. Münsterberg: *Studien zur Assoziationslehre*, Beiträge zur Exp. Psychologie, I. 1893 (Heft 4), 1-39.

² G. Cordes: *Experimentelle Untersuchungen über Assoziationen*, Phil. Stud. XVII. 1901, 30.

³ G. Aschaffenburg: *Experimentelle Studien über Assoziationen*, Psychol. Arbeiten (Kraepelin), I. 1896, 209-299.

had never in the past been consciously associated and attended to. A fair question with regard to the process of association is this: may process A suggest process B, both of them being conscious processes, by means of an intermediate process, C, which is not a conscious process at all, but exists only on the physiological level at the time when it functions to connect A and B, though it may quite well have been accompanied by consciousness on previous occasions?

As an example of the kind of mental event to which we would apply the term "mediate association," we may give the following: The observer was instructed on hearing a stimulus word to respond with a word which should be wholly unassociated with it. The stimulus word was "cane." It started immediately in the observer's mind the verbal series "sugar—south." This was interrupted by the remembrance of the instruction not to give associated words. The word "storm" then came, purely as an auditory-motor word. After it had been given, there developed in the observer's mind the memory idea, chiefly visual, of uprooted trees and signs of devastation by a storm, seen from a car window on a recent journey to the southward. That this memory had not been in consciousness at all during the interval between stimulus and reaction word the observer, who had had long practice in introspection, was sure.

The occurrence of associations whose mediation does not come into consciousness in any recognizable manner is certainly an interesting and well-attested phenomenon. We have undertaken to study it by a method which we believe to be new, and which furnishes in addition a good chance to observe the effect of a definite *Aufgabe* or task set the observer, in that the task here is directly opposed to the mental processes which would naturally occur in the circumstances if the task had not been set. The nature of this method has been already partly indicated. The observer was given the instruction that on hearing the stimulus word pronounced she was to respond by giving a word that had no association with it. She was further forbidden to take refuge in the too easy plan of giving a word suggested by any of the surrounding objects. She was not told to react as quickly as possible, but was allowed to take her own time. There were in all eleven observers, all women, but upon two of them only a few experiments were made.

In a certain number of cases the effect of these instructions was so to "set" the observer's mind that *the stimulus word did not start any associations at all*. "Thought of nothing at first;" "Stimulus had no effect at all;" "No associations with stimulus word;" "Stimulus just a word, auditory motor;" such are some of the statements describing this condition. For all the observers but one, A, cases of this kind occurred less frequently than those where the stimulus word started at least one or two associated ideas, *the train of associations being with effort broken off or inhibited*. These were the two ways in which the instructions were carried out. In a certain proportion of cases *the observer failed to carry out the instructions*; the reaction word was really connected with the stimulus word by a clearly realized chain of ideas, which the observer had found it impossible to inhibit. One observer, Cr., in the earlier experiments seemed to feel that she had carried out instructions if she followed the train of ideas started by the stimulus word far enough away to make the reaction word sound unassociated to one who did not know the intermediate links: thus with the stimulus word "match" she followed a train of ideas until she came in thought to a nail

on which her match box is hung, and gave "nail" as the reaction word. Practice overcame this tendency to a considerable extent. Under the head of failure to carry out instructions may also be classed the cases where the reaction word was given as unassociated when there was really a sound association between it and the stimulus word: the fact that they were unassociated in meaning seemed to make the reaction word elude the inhibiting influence of the *Aufgabe*. Thus for example take the following: "Stimulus word 'pearl,' reaction word 'puppy.' Introspection: 'no associations with stimulus word; the sound of p seems to have been the link.'" Or as another case: "Stimulus word 'curtain,' reaction word 'concert.' Introspection: 'No images. Concert came from sound suggestion of c.'"

These, then, were the typical methods of reacting to the stimulus word itself as a consequence of the instruction to answer with an unassociated word: either the stimulus word was, so far as the observer's introspection went, without any associative effect; or it started a train of ideas which was interrupted by recollection of the instructions; or the train of ideas was not inhibited, the instructions being wholly unfulfilled; or meaning associations were inhibited but sound associations persisted and determined the reaction word. We next have the question: How was the reaction word obtained in the cases where the instructions were carried out?

(1) In a considerable number of cases the reaction word was connected with some recent experience of the observer's. Thus for example: "Stimulus word 'easel,' reaction word 'oranges.' Introspection: 'Associated words and picture of Hudson River all inhibited: recent experience of seeing oranges came into mind.'" "Stimulus word 'path,' reaction word 'steamship.' Introspection: 'Visual and verbal images—bridle path, horse, O's brother—all inhibited. Visual image of picture of boat seen recently.'" One observer in particular, B, was especially given to this method of getting a reaction word, using it in 23% of 164 experiments. Observer Ab, on the other hand, furnished no instances of this type in the 72 experiments made with her. It may naturally be asked what determined attention to a particular recent experience rather than to others: why did the observer think precisely of the oranges she had recently seen and not of some other object lately experienced? The observers could give no answer at all to this question.

(2) Another device, closely akin to the one just described, by which a reaction word could be obtained that would escape inhibition by the *Aufgabe*, consisted in what the observers sometimes called "taking a walk." That is, the attention was drawn to memory ideas of the surroundings, usually the out-of-doors surroundings, of the room in which the experiments occurred. Since the observers were forbidden to get their reaction words from present objects, this was a kind of outward roaming in space, as the recalling of recent experiences was an outward roaming in time. Examples are the following: "Stimulus word 'eraser,' reaction word 'lamp.' Introspection: 'Visual pencil suggested, then no further associations; process of hunting around out-doors for something to say; came to arc light by lodge.'" "Stimulus word 'broom,' reaction word 'piano.' Introspection: 'Had no associations. Went wandering around the halls, then into Assembly Hall and saw piano.'"

(3) In another set of cases the reaction word is derived from verbal perseveration. This set may be subdivided in the following way. (a) Sometimes the reaction word is itself a perseveration. There were four subclasses under this head. The first subclass com-

prises those instances where the reaction word is a recurrence of a preceding reaction word. There were altogether six examples of this: in all of them the previous occurrence of the reaction word was at least six experiments back. In every case the reaction word was recognized by the observer, in giving it, as having been given before. The cases were as follows: "Pipe-pencil" (previous day); "maze-steamship" (12 experiments before); "game-bush" (7 experiments before); "canoe-bird" (6 experiments before); "fur-silver" (six weeks before); "frame-appletree" (apple one month before). The second subclass includes those cases where the reaction word is a recurrence of a previous stimulus word. There were three such instances: "hammer-nest" (7 experiments before); "umbrella-cane" (3 experiments before); "easel-canoe" (2 days before). "Umbrella-cane" was really a direct association, and was criticized by the observer as "too near" as soon as she had given it, but she also recognized the influence of the stimulus word "cane" which had been used shortly before. A third subclass includes cases where the reaction word was one recognized by the observers as having been used in recent experiments of a different kind; there were three such cases, namely, "roof-float," "teapot-hen," "orchard-barouche." In the fourth subclass we have placed three examples from one observer, W, who is of a decidedly motor-verbal type, of the use of words as reaction words which have a general tendency to recur in all experiments of any sort with this observer: favorite words as it were. The cases were: "net-holiday," "key-sermon," "trout-star," "school-comet."

(b) Sometimes the reaction word, while not itself a perseveration, is suggested by association with a word which perseverates. The association may be either through sound or through meaning, and as before, the word which perseverates may be either a former stimulus word, or a former reaction word, or a word from some other source. There were six cases where the reaction word was suggested by sound association with a former reaction word which perseverated. They were the following: "Floor-capitol," from sound of "candle," reaction word 7 experiments back; "Canopy-fringed," from sound of "fright," r.w. on previous day; "Whistle-billow," from sound of "willow," a favorite word of the observer's, used as r.w. three experiments before; "Bush-stand," from "strain," r.w. on the previous day; "clock-answer," from sound of "absence," preceding r.w.; "Alcohol-arrest," from sound of "absence," r.w. 5 days before. There were also six cases where the reaction word was suggested through association with the meaning of a previous reaction word which perseverated. They were: "Broom-candle," from "silver," preceding r.w.; "Pencil-bluebird," from "willow," preceding r.w. and a favorite word of the observer's; "Sermon-rubber-tire," from "popgun," preceding r.w.; "Stone-sparrow," from "willow," favorite word; "Key-orange," from "pink," r.w. 10 experiments before; "string-kite," partly direct, but influenced by preceding r.w. "boy." There was one case where the reaction word came through sound association with a preceding stimulus word which perseverated: "Ladder-violet," through sound association with preceding s.w. "violin." There were three cases where the reaction word was suggested by meaning association with a perseverating stimulus word; as follows: "Jabot-tree," the reaction word suggested from the previous stimulus word, "camp;" "Match-snow," from the stimulus word "sled," three experiments back; "Umbrella-bird," from the preceding stimulus word "net." It may be noted that in this gen-

eral class (b), where the reaction word is not itself a perseveration but is suggested by a perseverating word, the word which perseverates is apt to be of more recent occurrence than in class (a). There were eight cases under class (b) where a word perseverating from the preceding experiment exerted an influence, and no case under class (a) where a word occurring less than six experiments previously recurred. This is probably due to the influence of the *Aufgabe*: in seeking unassociated words, the actual repetition of recently occurring stimulus or reaction words would be avoided, but their influence is exerted indirectly through association.

(4) Closely allied to the perseveration of words is the apparently spontaneous occurrence of certain letters as initial letters for the reaction word. In all the experiments performed there were fourteen such cases: the following may serve as examples: "Stimulus word 'string,' reaction word 'lace.' This sound persisted and was inhibited: l came." "Stimulus word 'easel,' reaction word 'rain.' J's and s's inhibited; r chosen." The experience seemed to be that of inhibiting meanings in general and trying for something purely auditory-motor: why several initial consonants should sometimes be inhibited or rejected before one was finally "allowed" to suggest a word, the observers themselves could not explain.

(4) In a very large number of cases no reason whatever could be obtained from the introspections of our observers for the occurrence of the reaction word. For the observers who were most thoroughly tested the percentages of such unexplained reactions were as follows: A. (155 experiments in all), 43% unexplained; Ab. (72 experiments), 30% unexplained; B. (164 experiments), 26% unexplained; Ch. (35 experiments), 25% unexplained; Cr. (71 experiments), 43% unexplained; S. (32 experiments), 40% unexplained; W. (61 experiments), 28% unexplained; Y. (34 experiments), 70% unexplained. Observer Y had had no previous training in introspection, which may in part account for her high percentage; W had had more than the others, Ab. came next, and the rest were equal as regards their introspective experience. A few examples of these unexplained reactions may be quoted.

Observer W. "Stimulus word 'soup,' reaction word 'tragic.' 'Soup of the evening' came verbally, image of Mrs. K. Inhibited; impulse to think of abstract word: 'tragic' came purely as auditory-motor word."

Observer W. "Stimulus word 'path,' reaction word 'salmon.' Faint visual images of path to Sunset Hill and words 'Sunset Hill.' Inhibited: 'salmon' purely auditory-motor."

Observer A. "S.w. 'sled,' r.w. 'figure.' No associations suggested by s.w.; r.w. came purely as a word, without images."

Observer S. "S.w. 'door,' r.w. 'circle.' Word 'gate' inhibited; visual image of a circle came without apparent connection."

Observer Cr. "S.w. 'saucepan,' r.w. 'ring.' Stimulus word inhibited at once; got visual picture of gold ring."

How is the occurrence of the reaction words in all these cases to be accounted for, when the observers themselves can give no explanation of it? In a good many cases, probably, better introspection would show that some recent experience is responsible for them, and that the instances belong, therefore, to the class which we have numbered (1). In other cases the reaction words may be verbal perseverations not recognized as such. To call an idea, whether verbal or otherwise, a perseveration is, however, only partially to explain its occurrence. In so far as it has been recently or fre-

quently in the mind, we know that it has a certain readiness to recur at the bidding of slighter causes than would produce it if its previous occurrence were of earlier date or rarer; but of what causes actually do produce it we declare ourselves ignorant when we call it a perseveration. Since those causes do not appear in consciousness, we must think of them as merely physiological processes, and the question whether they are of the same nature as the processes which underlie association,—whether the cases in question are really, that is, mediate associations,—or whether they consist in the “spontaneous” recurrence of activity in certain neurone groups, is one we cannot answer.

(5) In a certain number of the experiments the stimulus word and the reaction word were really associated quite directly, but the observer did not recognize the fact at the time the reaction word was given. She believed herself to be obeying the instructions and giving an unassociated word, but immediately after pronouncing the reaction word she realized that it was not unassociated, but connected immediately with the stimulus word. It is not possible to draw a hard and fast line between cases of this type and true mediate associations, as we interpret the latter term. The distinguishing mark which we have attempted to apply is this: in cases of the type now being discussed the association between stimulus word and reaction word is direct, although not recognized at the moment when the reaction word occurs to the observer's mind. In cases of mediate association the connection between stimulus word and reaction word is through a well-marked intermediate link, which is not in consciousness at the time when it functions to connect the two. Probably in the cases which we are now considering, of direct though unrecognized connection between stimulus word and reaction word, the instructions are responsible for the fact that the connection is unrecognized. The observer is told to avoid associations with the stimulus word: the way to avoid associations is to direct attention away from them, and thus to ignore them when they are present. The following may serve as illustrations of this class of cases.

Observer Ab. “S.w. ‘net,’ r.w. ‘rush.’ Tennis images inhibited: mind a blank; after giving r.w. realized its association with tennis.”

Observer Cr. “S.w. ‘game,’ r.w. ‘tree.’ Saw small balls and discs used in game; then had basket-ball associations, inhibited them, saw a tree; after giving word realized that it was the tree on the basket-ball field.”

Observer A. “S.w. ‘violin,’ r.w. ‘Easter.’ Both were mere words, with no apparent association, but after giving r.w. thought of Easter music in which a violin was played.”

Observer Ch. “S.w. ‘fork,’ r.w. ‘lemon.’ Images of spoons, knives, etc., then absolute inhibition. Then visual picture of lemon; after giving word saw lemon fork on dish of sliced lemon.”

(6) We come now to the cases of true mediate association found in these experiments. Before quoting them we must take account of one consideration. We have just said that probably the occurrence of the cases classified under (5) is due in part at least to the influence of the instructions. Stimulus word and reaction have a direct, conscious association, from which, however, attention is diverted in consequence of the instructions. As soon as the reaction word is given, the association between it and the stimulus word is attended to. Now in a mediate association, on the other hand, we are supposing that the link between stimulus word and reaction word is a more complex affair, and that it is not a conscious affair, but a

purely physiological process. If the case is recognized as one of mediate association, however, and does not have to be relegated to the "unexplained" class, the link occurs to the observer's mind afterwards. But may we not say, then, that in these so-called mediate associations too the link was really present in *consciousness* at the time when it functioned, but was unattended to because of the influence of the instructions? If such be the case, our mediate associations would not deserve the term, because the link would not be purely physiological.

It is not possible to meet this objection with a sharply defined answer, because we are dealing with matters of degree. Who could assert that a process responsible for the succession of one idea upon another is wholly physiological, unaccompanied by even the faintest trace of consciousness? The question as to whether we have obtained in these experiments true instances of mediate association may be held to turn upon another: how much ignoring of processes really in consciousness can be ascribed to the influence of the instruction in our experiments? To recur to the sample of our mediate associations which we gave at the beginning of this article: is it conceivable that the picture, of upturned trees and general devastation seen from the car window, which linked together "south" and "storm," could have been present in consciousness at the time of its functioning as a link, and have been completely unattended to because of the influence of the instructions not to associate? But perhaps, it may be argued, the whole picture did not need to be there in order to establish a connection on the conscious level; some fragmentary process might have represented it in consciousness, might have been ignored by attention, and might still have formed a psychological link, so that no mediate association, or association by purely physiological intermediaries, occurred. Now at this point we are brought face to face with the whole fundamental problem regarding the trustworthiness of introspection. When, after the reaction word has been given, the observer brings into mind the idea of the picture from the car-window, which represents the link, does her introspection, recalling the experiences that intervened between stimulus word and reaction word, discover there any traces of a conscious process representing in any way this link? If it does not, and if it is practised introspection, then to deny its authority is no more and no less than to reject what many of us regard as the fundamental psychological method. It may often be hard to decide whether a given case should be classified as a mediate association or under class (5), just discussed. But there is, after all, a difference between the two classes: in the cases which properly belong under class (5) the observer's introspection, recalling the experiences between stimulus word and reaction word, recognizes that the link was there in consciousness, although not attended to sufficiently to reveal the fact that it was a link; in the true cases of mediate association the observer can find no trace of the intermediate process whatever on reflecting on the contents of the interval between stimulus word and reaction word.

Out of the 662 experiments we made, 77, or 11.6%, gave us cases which we counted as mediate associations. For the observers upon whom the greater number of the experiments were performed, the percentages of mediate associations were as follows: A., 9%; Ab., 19%; B., 7%; Ch., 8%; Cr., 12%; S., 15%; W., 16%; Y., 14%. There follow one or two typical cases from each observer:

Observer W. (who had had much more practice in introspection than any of the others). "S.w. 'saucepan,' r.w. 'birthday.' Vague pictures of observer's room, and of dishes as they had recently been taken from a closet and placed on the table. Inhibited. Word 'birthday' came purely as a word, auditory-motor. Afterwards the connection was traced as follows: the observer had been talking of birthdays that morning with a person some of whose dishes are now in the observer's closet."

"S.w. 'cowboy,' r.w. 'Sunday.' Several words associated with the s.w., among them '101 Ranch,' were inhibited. A blank followed, and then the word 'Sunday' came, purely as an auditory-motor word. Afterwards the observer remembered that on the previous Sunday while in a street-car she had heard people behind her talking of '101 Ranch.'"

Observer Ab. (whose practice in introspection covered several years). "S.w. 'cello,' r.w. 'Frank.' Several visual images and words connected with music occurred and were inhibited. The word 'frank' came with the adjective meaning attached. Afterwards, the word became a proper name, that of a professor of music among the observer's acquaintances."

"S.w. 'newsboy,' r.w. 'ocean.' Ideas of the *Tribune's* dinner for newsboys occurred and were inhibited. The word 'ocean' came accompanied by a visual picture of the ocean. The observer then remembered reading in the *Tribune* an account of the stranding of the *Princess Irene*."

Observer A. "S.w. 'bell,' r.w. 'Egypt.' The words 'class bell, Rockefeller Hall,' were suggested; then a blank due to inhibition, then the auditory-motor word 'Egypt.' Afterwards she remembered that Egypt had been mentioned in a class in Rockefeller Hall that morning."

Observer B. "S.w. 'ruffle,' r.w. 'cadet.' A few associations with s.w. inhibited. After giving r.w., remembered having seen a girl starting for West Point that morning with ruffles on her coat."

Observer Ch. "S.w. 'match,' r.w. 'Miss E.' Ideas connected with lighting match inhibited. 'Miss E.' came verbally. Afterwards the word 'maps' came [Miss E. is a professor of history] and its sound association with 'match' was recognized."

Observer Cr. "S.w. 'dustpan,' r.w. 'circus.' Associated images of brooms inhibited. Visual image of circus ring presented itself. Afterwards realized that the connecting link had been 'dust.' (This case perhaps belongs in class (5). Observer Cr. gave few good instances of mediate associations).

Observer S. "S.w. 'pail,' r.w. 'out-of-doors.' Associations with 'pail' inhibited. Picture of 'out-of-doors' as seen from corridor window. Immediately afterwards remembered hearing lately of a certain Dutch painter who always put a pail in the foreground of out-of-doors scenes."

Observer Y. "S.w. 'theatre,' r.w. 'classroom.' Visual images connected with opera inhibited. Visual picture of a classroom; after giving word realized that it was the *music* classroom, from which the observer had just come." (This case, also, might be interpreted as belonging to class (5). Observer Y. had had no practice in introspection).

Of course the possibility must not be overlooked that some of our supposed mediate associations are *ex post facto*; that is, that after the reaction word has been given, and the stimulus word is recalled, an association is made between them which had no function, either

physiological or psychological, in producing the reaction word. Yet to suppose that this was regularly the case would be to leave the origin of the reaction word completely unexplained. It certainly seems likely that in the majority of cases where a reaction word occurs with no other demonstrable reason for its occurrence, the reason is to be found in a link which immediately afterwards presents itself to the observer's consciousness: the burden of proof would lie upon the person who should deny such an explanation. Very likely some of the cases which we classed as mediate associations do not properly belong under that heading. But we are convinced that the method furnished us with a number of associations whose link was physiological rather than psychological.

The peculiar feature of our method lies in the nature of the instructions given to the observer, and it will be well to summarize in closing the effects which those instructions had. The instructions set up, as it were, a barrier against the occurrence of the series of processes that would have followed upon the stimulus word in ordinary association experiments. What was the nature of the processes which, to continue the figure, got past the barrier? They were, briefly, the following:

(a) Sound associations. The instructions diminished attention to meanings, since through meanings associations most conspicuously arise, and sound associations consequently took on increased influence.

(b) Perseverating ideas from recent experiences. The checking of the train of ideas which would be naturally suggested by the stimulus offered an opportunity for these to assert themselves.

(c) Perseverating reaction words, and to a less degree perseverating stimulus words, but not those used in immediately preceding experiments.

(d) Words associated through sound or meaning with perseverating reaction or stimulus words, even those of the experiment immediately preceding.

(e) Directly associated ideas which are, however, not sufficiently attended to to make the fact of their association clear: this failure to conform to the conditions of the experiment is probably due to the instructions themselves, which naturally have a tendency to direct attention away from the ideas suggested by the stimulus word, and in these cases simply allow the associative connection to be overlooked.

(f) Ideas which are connected with the stimulus word by an intermediate process which has no conscious accompaniment: mediate associations.

XIX. A STUDY OF THE IMAGES REPRESENTING THE CONCEPT "MEANING"

By MARY, W. CHAPIN and M. F. WASHBURN

"I see meaning as the blue-grey tip of a kind of scoop, which has a bit of yellow above it (probably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material. I was educated on classical lines; and it is conceivable that this picture is an echo of the oft-repeated admonition to 'dig out the meaning' of some passage of Greek or Latin. I do not know; but I am sure of the image. And I am sure that others have similar images. I put the question not long since to the members

of my graduate seminary, and two of the twelve students present at once gave an affirmative answer. The one reported the mental unrolling of a white scroll; what he actually saw was a whitish lump or mass, flattened and flattening towards the right. The other reported a horizontal line, with two short verticals at a little distance from the two ends. The suggestion in these two cases is plain enough: meaning is something that you find by straightening things out, or it is something that is included or contained in things. There was, however, no such suggestion in the minds of my informants: for them, as for me, the mental representation of meaning is a simple datum, natural and ultimate."

This passage, from page 19 of Titchener's "Experimental Psychology of the Thought Processes," down to the sentence beginning, "The suggestion in these two cases," was read to a large class of beginners in psychology, and they were asked each one to introspect as carefully as she could the nature of the imagery which in her mind stood for the idea "meaning;" that is, represented not any particular meaning, but meaning in general. The students, all women, responded with written accounts that bore the marks of excellent introspection in the great majority of cases, considering that they had had but little training. One hundred and ninety-three good papers were received.

All of the imagery described was either wholly visual (50%), wholly kinaesthetic (36.7%), or visual and kinaesthetic combined (13.3%). Besides this classification according to modality, the images reported may be divided into the two groups of relevant and irrelevant. Relevant images are images whose connection with the word "meaning" through ordinary associative processes may be traced: Titchener's "blue-grey scoop" is a relevant image, because it can be traced to the idea of "digging out the meaning." In the case of irrelevant images no reason can be given to explain the suggestion of the image. The proportion of irrelevant images was decidedly greater where the imagery was visual than where it was kinaesthetic. The following statement summarizes the images in each class.

KINÆSTHETIC IMAGES

a. Relevant

Movements of the head or parts of the head. Frowning, 28. Nodding forward, 7. Sensations from head and throat, 3. Sensations from throat, 2. Stiffening of jaw, 2. Lips forming word, 4. Lip tension, 1. Mouth tension, 3. Teeth set, 2. Eye muscles tense, looking intently, 3. Looking into space, 1. Eyes closed, 2. Eye movements up and down as in looking up word in dictionary, 1. Eyes narrowed, 1. Lifting eyebrows, 2. Wrinkling nose as in pronouncing word emphatically, 1. Shaking head, 1. Turning head to get behind it, 1. These ideas are all classed as relevant, because they are all movements connected either with general effort, such as would be felt in trying to get at the meaning of something obscure, or with pronouncing the word, or with trying to see something; they are all movements that might be made in connection with getting at the meaning of something.

Movements of arm. Stretching up, 2. Grasping, 2. Fist clenched, 2. Grasping something and shoving it away, 1. Raising hand to head, 1. Pulling out a tangle, 1. Pushing against something hard, 1. Pushing forward, 1. Pointing with right forefinger, 1. Groping in the dark, 1.

The connection of all these with the word "meaning" is fairly clear: meaning is something to be reached for, grasped, pointed to, groped towards, disentangled: the pushing, fist clenching, and putting the hand to the head seem to represent merely effort in general.

Breathing movements. Catching breath, 1. Breathing slow and half suspended, 1. These apparently signify effort.

Movements involving the trunk. Leaning forward, 1. Inhibition of all motion, with sensations of effort, 1. Relaxing all the muscles, 1. The leaning forward, like the movements of intent looking, is apparently connected with the effort to *see* meaning. In the relaxing of effort we have the only kinæsthetic image which represents meaning as found or perceived: all the other images of this class are connected with the process of finding meaning, which involves effort, strained attention, frowning, fixed gaze, and so on.

Movements for which the part concerned is not specified. Penetrating dark mass, 1. Delving into something, 1. Poking around in corners, 1.

It is evident that the relevant kinæsthetic images suggested by the word "meaning" fall into two groups. In the first place, we have images of the movements which accompany effort to find the meaning of something, and in one case the movements of relaxation which accompany the discovery of meaning. All these movements are intimately and naturally connected with the process of seeking meaning; their connection with it involves nothing symbolic or figurative. In the second place, we have images of movements which symbolize the mental process itself of seeking for meaning. Reaching, pointing, grasping, disentangling, groping: these are not movements which one actually makes when trying to think of a meaning, as frowning is. They are movements which are thought of in connection with the process because they have some analogy to what goes on in the mind at such a time. It is noteworthy that all these symbolic movements are movements of hand and arm. It is the arm and hand muscles alone which naturally take part in movements that are signs voluntarily used; movements of the facial muscles and of the trunk are more commonly connected with the involuntary, natural expression of experiences. The movements involved in articulating the word must of course be excepted.

b. *Irrelevant*

Only a single kinæsthetic image was reported whose connection with the word could not plausibly be traced. This was the image described as "dragging down till one strikes hard bottom." Very likely it was really relevant in a symbolic way, and was derived from the idea of "getting to the bottom of things;" if the word had been "digging" instead of "dragging," the connection would have been clear.

How far these processes which we have classed as kinæsthetic images were actual sensations resulting from movements at least incipiently performed, we cannot say. Our observers were unequal to the very difficult introspective task of distinguishing between kinæsthetic sensation and kinæsthetic image.

VISUAL IMAGES

a. *Relevant*

The visual images whose connection with the word "meaning" can be traced may, like the kinæsthetic images, be roughly divided into those where the association is direct and those where it involves

symbolism. Under the first head we have a group of cases where "meaning" is represented by the visual image of an object used in getting the meaning of a word. Just as the most common kinæsthetic image was that of frowning, so the most common visual image was that of a dictionary, which occurred in 13 cases. One observer reported the visual image of a dictionary page; one that of the page with a hand pointing to a word. The image of a person in the attitude or with the facial expression of one looking for a meaning was also met with in several cases: two observers reported seeing the image of a person with a puzzled face, one that of a thoughtful face, one that of a thoughtful face suddenly clearing, four observers that of a person bending over a desk or a dictionary. Visual images of words also occurred. One observer reports "a word in heavy black type followed by an equality sign and other words in small type, each of which has an authority after it in abbreviation." Another sees a word with two or three lines of writing underneath. A third sees a printed page with space between the words and the paper as if the words were raised. So far as this latter feature is concerned the image may be classed as irrelevant, since its association with "meaning" is not clear. Another case of an image which is partly relevant and partly irrelevant is that reported by an observer who saw the word "meaning" itself in print, "the letters having a sneering expression." In the case of the following images the connection with "meaning" is quite direct: "a scowling person pointing at a word and asking me what it means;" "several people discussing."

The number and variety of the visual images which stood for "meaning" through a symbolism which represented the actual mental processes involved in finding the meaning of a word, instead of merely giving the bodily movements or physical objects connected with the expression of these mental processes, as a frown or a dictionary, were much greater than the number and variety of the kinæsthetic images belonging to the same class. These visual images may best be considered in groups according to the particular feature which they emphasize of the mental processes involved in seeking meaning.

(1) *A word and its meaning are equivalent.* Four observers saw an equality sign; one observer saw an equation; one observer describes her image as that of "a large grey bulk with an equality sign, on the other side of which is the bulk broken into small pieces." The equality between a word and its meaning is constituted by the fact that word and meaning have the same associative tendencies.

(2) *Meaning is something to be grasped.* One observer sees "a knotted and gnarled hand extended as if to grasp something." Another describes "something reaching out with tentacles to grasp an idea." Still another sees "a dark brown object with countless dark arms, gathering in more of the brown substance." The symbolism of grasping is probably derived from the fact that meanings are usually complex ideas, whose parts have to be attended to in rapid succession, so that their relations appear.

(3) *Meaning is something to be unravelled or disentangled.* The following images are due to this conception of meaning: "a white background with a faint tracery of intertwined and knotted lines;" "a tangle of fine lines all leading to a black centre;" "a machine stitching and unravelling." The disentangling or unravelling metaphor is doubtless also due to the fact that meanings are complex. While the metaphor of grasping refers to the necessity of rapid passage of attention from one element in a meaning to another, so that the

relations may be apparent, the metaphor of disentangling seems to refer to the necessity of definitely attending to the different elements; in other words, to the need of not passing too rapidly from one to another.

(4) *Meaning is the inner aspect.* The following images are evidently based upon this feature of meaning: "Something within something—children's blocks fitting one inside another;" "The innermost part of something which like a nut has an important inner part and less important outer ones;" "A paper bag with a twisted top which opens up;" "A man holding a bushel basket and pouring many silver dollars out;" "A square box, with a piece of string coming from a hole in the centre of the cover;" "The inside of a square box, with something coming out of the front;" "A white something covering something;" "A bronze jar into which I wish to peer;" "Something unfolded piece by piece, like the flaps of an envelope, or petals, to get at the center." As it requires some physical effort to get at the inside of a physical object, so it requires more strained attention to make the meaning of a word or sentence focal than merely to produce the words. Closely akin to this metaphor is that of *digging*, which we found among the purely kinæsthetic images, and which occurs also with visual accompaniments: "Shovel digging into something dark revealing light;" "Some dark substance being parted with hands to get at bright clear object seen in depths." The same aspect of remoteness is involved in the following images: "A spot at the far distant end of a long cone-shaped opening through tiers of layers; the openings in the tiers are, in some cases, eight, in some cases, six-sided,—each opening being smaller than the one before it."

(5) *To get at meaning is to make clear, to illuminate.* This very interesting aspect of the process of getting at meaning was evidently foremost in the minds of a number of our observers. The last two examples quoted under the previous heading give evidence of its influence, and the following show it plainly: "A cloudy sky suddenly clearing;" "A streak of light against a dark ground;" "A single light on a dark ground;" "A dark spot on which a bright light is suddenly thrown;" "Something dark opening up and disclosing a light spot [this involves also the 'inner aspect' ideal];" "A dark ditch with a single bright stone at the bottom;" "A dark room with a small glowing light in one corner;" "A black space through which comes a thin radiant stream of light;" "The sun coming from behind a cloud;" "A dark cloud which has just passed over a mountain that is very distinct;" "Many small dark clouds obscuring much light;" "Lighting a candle;" "A glass of dirty water and something dropped into it to make it clear;" "A ball of opaque glass gradually becoming crystal." Why does the metaphor of light coming into the midst of darkness express the mental process of getting at meaning? Is it not principally because darkness and failure to understand are both conditions which produce stagnation and lack of change in consciousness; darkness because it checks movement, and lack of understanding because it checks a free play of associations?

b. Irrelevant

The numbers of images whose associative connection with the word "meaning" is obscure was much larger in the visual and visual-kinæsthetic classes than in the purely kinæsthetic class. Doubtless the far greater richness and variety of visual experience as compared with kinæsthetic experience is a sufficient reason for this fact.

Some associative connection does of course exist in all these irrelevant images, and now and then one may hazard a conjecture as to its nature, but only a conjecture. Even in the images classed as relevant there is much that cannot be accounted for: one can see why "light in darkness" should express "meaning," but one cannot explain, and very likely the observer herself could not, why the particular image of "a ball of opaque glass gradually becoming crystal" made its appearance. The visual images for which no associative connection could with any certainty be predicated were the following: A circle; a soft pliable mass of clay; an empty picture frame (possibly these two referred to the abstract nature of the word, no particular meaning being referred to, but meaning in general); a dark grey round substance; a flickering candle; a rolled piece of parchment tied with a ribbon; an oval greyish-white convoluted space with a solid dome over it; a vast plain extending beyond the reach of the eye; the shell of an English walnut, the two halves fitting closely together; little sprites gesticulating wildly; a little girl falling down stairs and skinning her knee; a very bright, rather transparent glow over the whole inner field of vision; a hard small dull yellow surface; a blue green color and a pair of arms with boxing gloves, ready for action; something brown like baked beans; a cold blue long spike; a long sharp knife.

To base conclusions on the vexed question as to the psychological nature of meaning upon these results from unpractised observers would of course be unjustifiable. Incidentally, it may be noted that many of these images are undoubtedly suggested rather by current phrases in ordinary speech, such as "unravelling the meaning," than by the actual experience of the observers in getting at meanings. Yet such current phrases express certain actual experiences in the intellectual life of human beings: they are the records of introspection, however crude; they represent certain features that naturally belong to the process of arriving at meanings. Whether the following statement is an adequate description of a meaning or not, it expresses those aspects of meaning which are apparently most striking and most readily embodied in symbolic form: A meaning is a complex idea, suggested by association with that of which it is the meaning. Its parts must be attended to (meaning must be unravelled, disentangled), usually with some effort (meaning must be dug out; it is the inner aspect), in rapid succession to make their relations apparent (meaning must be grasped). When it is attended to, its further associative tendencies are recognized as identical with those of the word or idea whose meaning it is (meaning is an equivalent). But the word or idea of which it is the meaning did not itself set into activity these further associative tendencies: a block or stoppage in associative processes occurred which made the process of attending to the meaning necessary: the occurrence of the meaning relieved this stoppage (meaning is an illumination).

RECENT LITERATURE ON PSYCHOANALYSIS

By Dr. J. S. VAN TESLAAR

1. S. FREUD, Psychoanalytische Bemerkungen über einen autobiographisch beschriebenen Fall von Paranoia (Dementia Paranoides). *Sonderabdruck aus dem Jahrbuch f. psychoanalytische und psychopathologische Forschungen*, III., 1911, 9-68.

A psychoanalytical examination of paranoia would be impossible but for the fact that the patients possess the peculiarity of betraying, at least in some indirect way, exactly those features which lie behind their morbid selves.—while other neurotics instinctively conceal such manifestations. Paranoiacs can not be induced to suppress their internal conflicts; and their utterances and writings furnish material which is particularly valuable for psychoanalysis. Since the paranoiac demands sanatorium treatment, the opportunities for thorough examination of clinical cases are exceedingly rare; and for this reason Freud has chosen, for analysis, a published autobiography of a paranoiac.

This autobiographical record is Schreiber's "*Denkwürdigkeiten eines Nervenkranken*." It appeared in 1903; and although the author's manuscript had been censored and somewhat curtailed, it created quite a stir in German psychiatric circles at the time.

The author, Dr. S., reports that he twice experienced severe nervous breakdowns on account of overwork. His first illness, in 1884, was diagnosed by Flechsig, under whose care he had been for about six months, as a severe form of hypochondria; but at the end of the following year he was held to be completely cured. Nothing particularly abnormal was noted about the subject's mind during this illness.

His second breakdown occurred in 1893, nine years later. In June of that year he was appointed to the presidency of the senate. He occupied the chair on the first of October. In the interim he had had a number of dreams. They are mentioned in his autobiography because he states that he learned later to attach some significance to them. He dreamed of the return of his former illness. Once, upon an early morning, while lying in a state between sleep and waking, he had a very vivid phantasy "*dass es doch eigentlich recht schön sein müsse ein Weib zu sein das dem Beischlaf unterliege*,"—a bit of imagery which was repulsive to his nature and which his mind, in full consciousness, would have rejected with scorn.

The actual breakdown was ushered in, toward the end of October, by sleeplessness. This brought the patient to Flechsig's clinic again, where, in spite of treatment, he grew rapidly worse. He began complaining of brain softening, and felt that he must soon die. In the midst of these hypochondriac notions, ideas of persecution began to occur. These were fortified by a morbid aural and visual sensitiveness, at first; and later, by sensory delusions together with high-grade hyperaesthesia. These formed the background for a series of hallucinations of gradually increasing intensity which soon dominated the patient's whole sphere of thought. He was now a raving maniac. He

felt himself dead, his body abused and foully diseased. For hours at a time, the patient would be in a hallucinatory stupor; at other times, he was excited and he even attempted suicide. His incoherent mental wanderings gradually assumed a mystical, religious character. He became the plaything of devils; he communicated with God; he heard holy music; he witnessed supernatural phenomena; and he even believed that he now dwelt in another world.

During all this time he was haunted by people, especially by his former physician, Dr. Flechsig, to whom he scornfully referred, in his delirium, as "little Flechsig" and as "soul murderer."

In June, 1894, the patient was interned at a sanatorium, where he remained under observation for a number of years. The sanatorium physicians had opportunity to observe how his psychosis which had been chiefly hallucinatory, and which at first had involved the whole of his psychic activity in a rather acute form, slowly crystallized into a paranoid condition. At the same time, the field of his morbid thoughts narrowed so that alongside his morbidity his former self arose to reassert itself in many relations. His general mental condition improved so much that in 1899 the sanatorium director admitted that the patient was no longer at a disadvantage psychically or intellectually. Apart from some slight psycho-motor symptoms which might have warned the casual observer that there was something morbid about S., he appeared to be a well-behaved gentleman, of refined manner and speech. He showed wide knowledge and wide reading, not only in matters pertaining to his profession as jurist, but along many other lines of activity. He was greatly interested in scientific questions, in art and politics. His opinions on these matters, or on any aspect of social life, were well-thought-out, and interesting, and their ethical import above suspicion. Whenever delicate situations were approached in conversation, and humor touched dangerous ground, S. knew how to glide tactfully over them, if the presence of ladies required it. His wide knowledge and experience made him an interesting speaker; his memory was excellent. As to his morbidly determined notions, they formed a circumscribed and closed system of ideas, into which the light of objective reason was not allowed to penetrate. This was a feature of the patient's inner life which he could not be induced to bring into relation with reality.

Under the circumstances it is scarcely surprising that S. considered that he was capable of taking care of himself in society at large. He appealed for freedom from sanatorium restraint; and he pleaded his cause with all the cunning and the tact which is characteristic of many paranoiacs.

In the petition demanding his freedom, S. denied neither his morbid delusions nor his intention to publish his "*Denkwürdigkeiten*." On the contrary, he dwelt upon the importance of his unusual experiences for an understanding of mental life; and he pointed out the inability of science to explain them away. As to his hallucinations and delusions, he preferred not to gainsay the testimony of expert physicians concerning them; but he pointed out the harmless nature of the deeds to which they impelled him. He won his case; and in July, 1902, he was freed, although in the decision it was recognized that he was obsessed by the well-known world-savior type of delusion. One year later appeared his "*Denkwürdigkeiten*."

The particular interest of this case lies in the fact that this common delusion was associated with the unusual obsession that, before he can assume the rôle of world-savior and restore to the human race its lost happiness, he must change into a woman. It appears that this change

of sex was not a matter of choice or preference with S.; but on the contrary it was something decreed, fore-ordained,—a fate he could not escape, and with which he thought it would be best to reconcile himself. Already he was part female. He was gradually losing his male and acquiring female characteristics. Numerous female 'nerves' were running through his body. Through their direct impregnation by God he was to become the mother of a new race. Not until then would he be able to leave this world. But the process was slow; it may take years, perhaps centuries, to be rounded out properly.

All this he learned through direct revelation from God. He was also in constant communication with trees and birds. These spoke to him in voices akin to human; they were charmed, metamorphosed souls, perhaps of former human beings, but now inhabitants of another region.

Conservative psychiatry practically exhausts its interest in such cases when it traces their course and appraises the influence of the morbid system of ideas upon the life and future conduct of the patient; but psychoanalysis goes farther. It attempts to find out the actual mode of onset of symptoms, and to explain them by referring them to some fundamental cause. A knowledge of the etiology of other psychoses, and of the neuroses in general, emboldens the psychoanalyst to surmise that even such an intricate series of morbid thoughts and feelings, as is found in this case, is traceable directly to the commonest and most readily understood impulse of our psychic organization; and that after all, there is method even in the madness of a paranoiac. This is what Freud sets out to prove in his analysis of the case; and he bases his findings exclusively upon the patient's own autobiographical record.

The delusion of a metamorphosis into womanhood furnishes Freud with his first clue. Numerous passages in the book indicate that that was indeed the primary insane delusion. The savior idea was added later, and grew in proportions and in interest until it overshadowed the real nucleus of the whole system of morbid thoughts. The patient's own report also shows that the change to womanhood was devised, in the first place, as an act of persecution first by Dr. Flechsig, later by God himself. The voices spoke mockingly about his changing into a woman; they referred to it in words which showed that the change meant sexual degradation and disgrace. He heard himself apostrophized thus: "Are you not ashamed of your wife?" and "nice person to want to be President of the Senate!" Also, in anticipation of his complete change, the voices accosted him, derisively, as "Miss S.!"

Particular stress is laid upon this feature of the case by Freud. He sees in it an important clue. Indeed a foreshadowing of this idea of effeminization may be seen in the half-dreamy phantasy which the patient had experienced during the incubation period of his illness, that is, before he even assumed those heavy duties to which he ascribes his mental breakdown. The subconscious wish, which had led the patient to fancy that it must be very pleasant to be a woman during the act of sexual intercourse, was blended, as early as November, 1895, with the notion that the patient was destined to become the savior of mankind. And after that time he no longer resisted the idea of effeminization, which had originally been the salient motive of his insanity.

The patient's relations to his God constitute another significant feature of his mental condition. They are so intricate, so contradictory, that any one less sanguine that he is on the right track would be tempted to abandon the idea that they may be reduced to order and system. But Freud, emboldened by these very difficulties, proceeds systematically and patiently to analyze every item of the patient's insane

notions concerning 'nerves,' which play such an important rôle in his hallucinations, concerning salvation, the divine hierarchy, the properties of his God,—the patient's whole morbid system of theological-philosophical ideas. He finds the whole to be a curious mixture of the most varied notions, some fanciful, cunning, original, others quite commonplace, but fundamentally alike in their implications. Their sex symbolism is so apparent that it is not difficult to trace the real meaning of each. Sometimes, however, the patient's morbid representations are not even symbolical. The notion of heavenly bliss, for instance, is dwelt upon in patently sexual terms, "*als ob S.'s Seligkeitsbegriff durch die Verdichtung der zwei Hauptbedeutungen des deutschen Wortes 'verstorben' und 'sinnlich glücklich' entstanden wäre.*"

Thus, briefly summarized, Freud finds that the patient had formerly been inclined toward sexual asceticism and to scepticism in matters of religion, but had been transmuted, by his illness, into a libidinous individual who entertained God-fearing notions. Moreover, his newly acquired sexual desire assumed a most unusual form; it was a female sex feeling. S. felt himself to be a woman in his relations to God; indeed, in the fancy of his insanity, he was God's wife.

He insisted that his skin felt smooth and soft to the touch, like a woman's; and under it, as he pressed lightly with his fingers, he could feel, on any portion of his body, a fine mesh-work of "nerves." They were "female nerves;" and they were particularly abundant upon the breast region. "*Durch einen auf diese Gebilde auszuübenden Druck,*" writes the patient, "*vermag ich mir, namentlich wenn ich an etwas weibliches denke, eine der weiblichen entsprechende Wollustempfindung zu verschaffen.*" Particularly is this true of the region where the woman's breasts are found. He also states: "*Das Zeichnen eines weiblichen Hinteren an meinen Körper,—honi soit qui mal y pense,—ist mir so zur Gewohnheit geworden dass ich dies beim Bücken jedesmal fast unwillkürlich tue.*"

Relating this condition to the patient's dream-phantasy, Freud concludes that the morbid notion of turning into a woman is only the realization of that unbidden phantasy or day-dream. The patient's conscious self directed itself with revolt against this subconscious wish; and even after his breakdown, he fought against the thought, looked upon the plan as a scheme whereby his enemies plotted to humiliate him. The savior idea, introduced later, was the means of reconciling him to the idea of turning into a woman. This thought brought a new viewpoint into the crisis. The act of effeminization was no longer a degradation; it was God's wish and accorded with His divine plans,—not with the designs of persecutors who were plotting to commit "soul-murder" upon him.

Freud attempts to prove that the two main conceptions forming the backbone of this paranoiac's system of ideas,—his turning into a woman, and his peculiar relations to God,—form a coherent religio-psychic system, in which one is the logical corollary of the other. But the real psychoanalytical task, at this stage, is to correlate the two notions genetically; and to trace them, if possible, to some particular fundamental impulse or instinct which governs the ordinary psychic mechanism of man. Freud finds, further, that the patient's own statements offer all the evidence that is required to settle the origin and significance of the fundamental notions in his system of morbid thoughts. The patient, it will be recalled, is a man of unusual intellect. He is also frank, to the point of bluntness, in the telling of his story. This makes it a comparatively easy task to ferret out the thought-complexes which are responsible for his condition. Often

a quotation, an example, or an illustration used by S. to elucidate one of his insane notions betrays what he actually meant as well as the analyst could have wished. Usually, in such cases, it is only necessary to divest the statements of their prudish negative apparel, as is customary in psychoanalytical work, to take the quotation for the source of the thought, the example for the patient's own thought, and the whole matter becomes at once clear.

Here is a striking example of this technique. Incidentally it justifies, to some extent, this plan of analysis. S. was harassed by what he described as "charmed" or "speaking birds," as has been mentioned already. His insane fancy pictured them as belonging to the ante-courts of Heaven (*"Vorhöfe des Himmels"*). These are metamorphosed human souls whose function it is to serve as messengers. Among the many wonderful qualities ascribed to these birds is that of passivity with reference to the messages they bring him. That is, the birds learn to repeat words in a purely mechanical fashion, without being aware of their meaning. They bring him scornful, mocking, derisive messages without understanding their import. Even birds do not possess an accurate "ear" for sounds; and they frequently confuse similarly sounding words of different meaning. They do not distinguish between such words as "Santiago" and "Kartago," "Chinesentum" and "Jesus Christum," "Abendrot" and "Atemnot," "Ariman" and "Ackerman," etc.

Now, any one who may be disposed to accept the symbolism of which the Freudians make such constant use, would conclude at once that these birds represent young girls. "Chicken-brained" and "geese" are epithets which are sometimes ungallantly applied to girls who think it a mark of culture to employ high-sounding phrases with whose true meaning they are not familiar. Such young women oftentimes betray their ignorance by an inappropriate use of words of different meaning but of similar sound. But one whose attitude towards psychoanalysis is rather sceptical might not be inclined to accept a symbolism which is based upon such slender strands of evidence. The deduction that the birds are girls appears to be rather far-fetched.

It so happens, however, that in this particular instance there can be no doubt as to the justice of the Freudian view. Freud's interpretation is justified by the patient's own statements. The latter writes that, in order to distinguish his frequent bird visitors from one another, he called each by a particular name; and he gave them the names of girls, because, by their coquettish behavior, and in other ways, they reminded him of young girls. These names, in some instances, were approved by God, and thereafter were always applied to the respective birds. The birds, then, were girls; and we find herein a suggestion as to the nature of the "ante-courts of Heaven" with which they were associated in the patient's mind.

Freud finds that an important feature of the patient's malady was not appreciated by his attending physicians at the sanitarium,—namely, the ideas of persecution. In the early part of his illness, S. was a victim of his former physician, Dr. F., who "murdered or was about to murder the patient's soul." The exact nature of this crime is not stated; the portion of the manuscript which gave the details was withheld from publication by the censors. It appears, however, that the crime involved the loss of personality and self-respect.

The soul of his persecutor, for he dealt with the soul not with the earthly person of Dr. F., was polymorphous. At one time

there were as many as forty or sixty divisions or different forms of F.'s soul which tormented S. But of these, only two, the "upper F.," and the "middle F." persisted. It is noteworthy that the patient takes considerable pains to show that he himself distinguishes the polymorphous or bipartite "soul Flechsig" from the living person by that name,—the insane delusion from the real man.

Those who are familiar with psychoanalytic literature will recall the simple formula which has been proposed for the treatment of all manias of persecution. The person to whose hands the patient traces all the strings of the plot is in reality one who, before the breakdown, occupied the center of his emotional outflow, or one who now serves as a substitute for such a person. Under the powerful inhibition or restraint of that emotion, the strength of the emotional tone is perceived in terms of external power; and the emotion is replaced by its opposite as a subterfuge. The former lover or surrogate turns persecutor, and is now hated and feared. The greater the ties of love that bound the patient to him formerly, the greater is the power he now wields over the unhappy patient.

In the case under consideration, it will be recalled that during the prodromal stage of the disease, the patient dreamed a number of times that his former illness had returned. Placing this phenomenon and the patient's day-phantasy side by side, as indeed they co-exist in the patient's own experience, we see that his former illness recalled to mind the physician who had then treated him. The dreams must have owed their meaning to the wish to see Dr. F. again. The sexual phantasy that it would be pleasant to be a woman in the sexual act, must have had Dr. F. for object. The patient's wavering statements require but slight analysis to show that what he really feared and fought against, was sexual misuse by his physician. The subconscious homosexual wish became an act of persecution,—hence, the fear of "soul murder," and the delusion of a soiled, diseased, dead body. These symptoms are tongues of fire which show that the homosexual libido has broken out from within, and is being repressed. Thus interpreted, the symptoms fall into line logically, and almost explain themselves.

But it is not easy to understand why a gentleman's gratitude toward his former physician should change suddenly, eight years later, into a homosexual longing. Perhaps the character and mental calibre of the patient in question add to the difficulty. Freud meets this difficulty with considerations of a general order, whose strength and potency will be estimated differently by different readers. The theory, of course, is that man gravitates between heterosexual and homosexual feelings throughout his life; and that self-denials or disappointments may, particularly at critical periods, precipitate one into either extreme. There are certain facts which seem to indicate that this generalization holds good in the case under consideration. Thus it appears that at the time of his second breakdown, S. was in that critical period of life when the sexual functions of woman undergo marked changes, and when she becomes, largely on that account, peculiarly sensitive. He was fifty-one years of age. Now, since recently-accumulated evidence appears to show that man's sexual functions undergo certain corresponding changes, and that he also becomes, on that account, easily susceptible to certain morbid influences, it would appear, according to Freud, that the difficulties are more apparent than real. Man, as well as woman, passes through a climacteric phase. Therefore it is reasonable to suppose that, during this critical period

he also is subject to those morbid outbreaks which are frequently associated with the change of life in woman.

But some readers may object that notwithstanding all of this, it seems too fanciful to believe that a patient's sympathy or gratitude toward his physician may turn, some years later, into a perverted, morbid attachment, and break out suddenly with so much force as to cause the complete mental disorganization of a personality like S. Freud anticipates this objection, and meets it with the suggestion that possibly the actual relations between physician and patient may mean more to the latter than is usually the case, in fact, a great deal more emotionally than their formal intercourse would imply. It is quite possible, for instance, that the patient sees in his physician the *locum tenens*, the surrogate of a person very close to him, perhaps of a person in whom his whole emotional life was motivated subconsciously. Such transfer processes as these are frequent; they have been traced out in great detail in other morbid conditions. Until such possibilities have been disposed of we are not justified in abandoning the explanation altogether. We are certainly not justified in rejecting any view merely because it appears strange and unusual. It may be that, in the otherwise indifferent person of his former physician, S. was reminded of his father or of a deceased brother, with whom he wished to be in close *rapport*. Unfortunately, there are no data at hand concerning the subject's childhood phantasies and sex repressions. But Freud's persistent search through the book was rewarded by the discovery that the patient's father was, indeed, dead, and that a brother also had died. It is quite clear that the disease had its roots in a homosexual wish or fancy, with the person of Dr. F. for its object. The strong repression that followed, the intense struggle to which it gave rise as the patient's manhood rebelled against the unwelcome thought, took on the form of persecution. The contents of the wish-phantasy furnished the subject of persecution and the person longed for became the persecutor. But perhaps the real person longed for through the medium of F. is indicated by his identification with God, in the later course of the disease. At first this identification sharpened the conflict. With God as persecutor, the conflict naturally became more acute than ever. But somehow there ensued the notion that his turning into a woman was God's way of preparing him to become the progenitor of a new race, and the world's savior. He was no longer to become a woman for the sexual convenience of F., but for a divine purpose; the loss of his manhood, therefore, was no longer a disgrace. This change marked an important turning-point in the course of the disease. His ultimate metamorphosis into a woman, for God's sexual convenience, was shifted far off into the future. He will be a complete woman sometime; but meanwhile the person of Dr. S. was not to be molested, and hence the struggle was abated. He felt himself once more free from oppression. This transmutation of manias of persecution into grandomanias is not uncommon. It is supposed to be a process of rationalization, whereby the patient adapts himself to his new system of ideas; but Freud thinks it is unpsychological to ascribe such strongly affective products to the purely logical faculty of rationalization. He explains the transfer from F. to God, in the case of S., on affective rather than on logical grounds. This way of handling the problem brings one nearer to the very nucleus of the whole situation, as interpreted by Freud.

In the first place, the transfer occurs upon a single level,—that is, F. and God occupy, after a time, the same plane. This important

point is revealed incidentally by S., who overheard a conversation in which F. introduced himself as "God Flechsig." In other words, the persecutor splits into Flechsig and God, just as he had formerly split into "upper F." and "middle F." ; and just as God splits later into "upper" and "lower" God. In the course of time, this dissociation proceeds still farther; as has been mentioned. Incidentally Freud remarks that this process is characteristic of paranoia. Paranoia splits complexes just as hysteria condenses them; or, rather, it dissociates into their component elements those identifications or condensations which have previously been made by the subconscious.

Freud asks: Who is this God with whom the patient identifies Dr. F? This is the crucial point in the situation. Freud subjects the patient's relations to his God to a very searching analysis, and concludes that his notion of God is nothing more than a fanciful representation of his father. Indeed, the patient's father was a remarkable personality, a man who had played an important rôle in his day. But aside from that, one's childhood fancy always invests one's father with superhuman qualities. A child's deceased father is, to it, a God. Infants' phantasies are wrought together in mythical terms. Strange as this idea may seem to us, the deification of great men is not uncommon among primitive peoples. Even the Romans preserved, for many generations, the habit of deifying their deceased emperors as a mark of honor. It will be recalled that Emperor Vespasian, when he fell seriously ill for the first time, exclaimed: "I fear that I am about to become a God!"

The Freudian notion of the infant's relation to its father is well-known. It is one of rebellious opposition, born of jealousy, mixed with worshipful admiration, inspired by his unlimited powers,—exactly the attitude of S. to his God. With S. the fancy of turning into a woman is a rather typical formulation of the infantile complex and his struggle with F. stands, no doubt, for the well-known father complex.

One more point: Before a subconscious wish or phantasy breaks out, there must have been some keen denial or disappointment in real life, according to Freudian psychology. There was such a disappointment in the life of S.; and that probably had more to do with the outbreak of his insanity than had been suspected. His otherwise happy marital relations were marred only by the non-arrival of an heir. He longed for one very much. The supposition is, of course, that a boy would have proved a satisfactory surrogate for his deceased father or brother, and would have made possible the discharge of all his pent-up homosexual tenderness or love.

2. OSKAR PFISTER. *Hysterie und Mystik bei Margaretha Ebner* (1291-1351). *Zeitschr. f. Psychoanalyse*, I., 1911, 468-485.

The author has chosen Margaretha Ebner, a thirteenth century religious mystic, for a study similar to that of the life of Graf Ludwig von Zinzendorf. (See this JOURNAL, xxii., 1911, 416-419.) He psychoanalyzes her life in detail and points out the intimate connections between her religious fervor, her devotion to Christ, and her suppressed sex impulses. The latter furnish the content, the former the form of a long series of interesting morbid phenomena. Thus, masked under religious self-abnegation, her libido phantasies center around the physical person of Christ and pass among the religious for commendable self-abnegation,—the sufferings of a hysterical female for the martyrdom of a saint.

Briefly related, the details of her life and the writer's findings

in his study of it, are as follows: She was born in 1291. Concerning the first twenty years of her life very little is known; but during her twentieth year she experienced hallucinations in which she heard God command her to follow him,—a fact which indicates strong internal conflicts. Soon afterwards, in February, 1312, she fell seriously ill; her own description of her sufferings leaves little doubt that this was a hysterical breakdown. From that day until the end of her life,—a period of forty years,—Margaretha Ebner was never free from the stigmata of illness. During her long invalidism she suffered a great deal. At times, her physical tortures seemed almost beyond human endurance. But her bodily sufferings were compensated by emotions of joy and happiness such as few mortals have ever experienced. Her chief religious work,—the “*Offenbarungen*,” is essentially a continuous record of the primary and sublimated manifestations of her libido-phantasies, down to the year 1348. The ascetic restraints under which she lived her uneventful, contemplative life, only served to accentuate her morbid disposition. Hers was a true martyrdom of the flesh and spirit, though not of the kind imposed by the church, nor in the sense in which her memory has been sanctified by the pious.

Her concentration upon religion and her devotion to Christ, were so complete that few ties reminded her of the greater world outside; and in the course of time, she severed herself entirely from the world. She became estranged even from her own family, so that she was rather displeased when a sister visited her once at the cloister. Only toward Heinrich von Nordlingen, her confessor and admirer (probably also her junior in years), did she maintain cordial relations throughout her life. It was he, who, as her confessor, inflamed her soul with the desire to lead the secluded life of a nun, and to devote herself wholly to Christ. So well did he succeed that soon the pupil surpassed the teacher in self-abjuration. Her former spiritual leader and confessor turned into a humble admirer and follower of the pious nun, “*ir armer unwürdiger freund, ein klein wirmelein, ein suntlicher hintwurf aller geschepf.*”

Many details about her long illness are not recorded as accurately as might be desired. It is particularly unfortunate, for the purposes of a thorough analysis, that no data are at hand concerning her childhood; and no indications of her infantile repressions are obtainable. Then, too, the last years of her life are also shrouded in darkness. But it is known that her life in the cloister and her relations to Heinrich remained unchanged until the last; and it is almost certain that the condition of her health had not changed to any marked extent until shortly before her death in 1351.

From 1311, when she fell ill for the first time, until 1326, she remained half paralyzed, and had to be carried about. During the last thirteen years of this period, she was obliged to stay in bed half of the time. Her condition was so delicate, and her crises so severe that time and again her end was thought to be a matter of only a few minutes. So great were her sufferings that she often prayed that death might come as a relief to her sufferings.

Her astasia-abasia was intermittent. Through the intervention of divine grace she would frequently regain the use of her limbs. How long the relief lasted is not stated. Intense pain accompanied every attempt at motor activity. Her biography describes an attack of toothache and headache which lasted six weeks, during which time her head was so intensely painful that she could not bear to move it. She also experienced sharp pains in her heart. These were brought on by read-

ing of the sufferings of Jesus. The sorrowful look of the crucified Savior gave her "*ains innern smerzen in minen henden, as si mir erdent werent und zerzerret und durchbrochen wern, und want (cried) das si mir immermer unnulze werent.*" In other words, she transferred to her self the supposed condition of the hands of the crucified Savior. She even felt that the skin and bones of her hands were stabbed, broken through and shaken with pain; and so violent were her sufferings that the sisters could hardly control her with their arms. She felt a most painful breaking in all her bones, particularly in the sides and back, as well as in the arms and legs; at the same time, she was almost completely overcome by a horrible sense of impending death.

Hyperesthesias were common, and so intense that she could not bear to be touched on either body or limbs. The description of her "heart cramps" is very remarkable. It required the combined strength of several sisters to keep her under control. One would press under the sufferer's heart, while another would counterpress from behind, and the two would feel something alive turning under their hands,—a clear case of hysterical pregnancy. The woman's own description of her cramps suggests this diagnosis. She states that during her cramps she would swell "*als eine frau die gros mit einem kinde gaut.*" The swelling also appeared on the face and hands.

One day, while contemplating the passions of Jesus, a light entered her eyes and from there suffused slowly through every part of her body. She was so charmed by the sensation that she could scarcely regain her breath. On another occasion, at supper, her mouth contracted suddenly so that she could not eat. Usually, after Easter, she passed for one to three days into a peculiar state, during which her body felt hot and cold alternately. Among the automatic morbid restraints to which she was subjected, her involuntary silences, alternating with involuntary cries, chiefly of the name of Jesus, are the most noteworthy. At first, she observed silences at regular periods as a part of her ascetic rules of conduct. But after a time they became involuntary. The same is true of her frequent fasts; she soon lost control of the situation here also. Usually the silence and the fasting occurred simultaneously.

The silences were accompanied by a feeling of heavenly joy and peace; but they were interrupted by agonies of pain and fits of weeping. At times, however, exactly the reverse was the case. During these periods of enforced silence she retained power only for prayer. The uncontrollable outcries which usually marked the close of her hysterical mutisms were pitiful to hear; they were brought on, as a rule, by a contemplation of the sufferings of Jesus. It is repeatedly stated that these outbreaks were induced by a contemplation of some phase of the life of Jesus, such as the passion. But Jesus was also the means of her experiencing "*sueszen herzenslust;*" and frequently the passage from pleasure to pain and back again was very sudden. These and other circumstances betray the erotic nature of the hysterical phenomena. Even the name of Jesus alone, if frequently repeated, was sufficient to fill her heart with an indescribable happiness. There was something even about her most acute sufferings which gave her ecstatic satisfaction, especially if witnesses were present, and if sympathy were aroused.

The nun's intellectual faculties were, of course, markedly influenced by her hysterical state. Quite frequently she experienced hallucinations, such as the filling of her heart with a light which overflowed and suffused into every part of the body. Gustatory hallucinations also were frequent. The name, Jesus, repeated during prayer, filled her mouth with sweetness; and for the sake of this divine taste she refused to partake of any sweet morsel of food. Nothing tasted so sweet to her as

the sacramental wafer; she could feel the blood and flesh of Jesus upon her tongue all day long. She would drink only water; it tasted so sweet to her that she wondered why people ever drank anything else. In the summer of 1347, while her body was hot and cold alternately and perspired freely, a taste sweet as sugar persisted in her mouth for several days; and for its sake she refused every drop of water. She lost all desire for food in 1334; and for thirty years she abstained from meat, fish and wine. During her frequent silences she was preoccupied with her inner self, and ate nothing.

Olfactory automatisms were rare, but tactile hallucinations very common and vivid. God always appeared to her as Jesus; indeed, she thought of her God solely as Jesus. Once while she was praying to God Jesus appeared for a kiss and an embrace, and grasped her by the heart. The sensation remained with her for a long time. One night, she was awakened by the child Jesus; and instinctively she pressed to her bare bosom the image of the child, which she always carried upon her person. Thereupon she experienced the carnal touch of his lips; and she was completely overcome by the feeling. At another time, she felt herself embraced and kissed by the child Jesus, when, with apparent irrelevance, she suddenly became quite anxious concerning his circumcision.

She lived in the world of her hallucinations so long that gradually all the ordinary innervations of her body became faint; and her corporeal sensations became so subdued that she thought she was floating or was being carried about.

Dreams, visions and inspirations played an important rôle in the life of this mystic. Many of these are described in her autobiographical records. She dreamed that her deceased sister showed her the portals of heaven and an empty stool which awaited her. Angels told her in a dream that Heinrich von Nördlingen was within her body. Notwithstanding the absurd implication of this dream, her belief in dreams was not shaken. The symbolism of these two dreams is easily apparent to one who is familiar with Freud's "*Traumdeutung*."

Most of her dreams were about Christ. In one of them, she saw his naked body, clear and transparent as glass. The vision filled her with a flood of sensations, whose erotic nature is but slightly masked. She thought the body was to be eaten. She saw herself in a dream bedecked with the wounds of Jesus. She saw the child Jesus at play in his cradle; he gave her no peace until she took him in her arms and kissed him; thereupon he embraced her neck, and returned her kiss.

Her attitude toward the cross is very significant. This emblem was a surrogate for the body of Christ. She kept a cross with her day and night; and by pressing it to her heart she could make herself supremely happy. She also carried upon her breast an open booklet containing an image of Christ which she always placed upon the pillow, under her face, before falling asleep. She furtively appropriated from the choir another cross of larger size. This she placed directly upon her heart. Her own cross reached from the throat down, "*und da lag ich denn gedruket uf biz daz ich enschlief in grozzer gnad*." She had a mania for large crosses. Once she had a strong desire to steal another still larger cross; but it hung too high in the choir, and she could not reach it. One night she dreamed that she was standing before the image of Christ; he came down and offered her his open heart to kiss, and his blood to drink. Once she heard the voice of Christ admonishing her to nurse him, and warning her that if she refused he would withdraw himself from her later when she would need him most. Obediently, she placed upon

her breast a figure of the child Jesus; and she was filled with happiness.

Margaretha maintained long conversations with the child Jesus, whom she regarded as her own child. She learned from him that Mary bore him with great joy, and suffered no bodily inconvenience; and that she was delivered without pain. She asked him whether it is true that Joseph wrapped his first-born in his trousers, and was answered in the affirmative. This ascetic nun was particularly anxious to learn everything about the boy's circumcision. She was told that the operation was painful, and that the child lost a great deal of blood on account of it; but this did not seem to satisfy her curiosity. Again and again she asked questions of Jesus, relating to this point. She also inquired into all details concerning Mary, the mother, and Mary Magdalene. Many of her questions were as pointed as they were sensuous.

One day she discovered, much to her distress, that she had forgotten the words of her paternoster,—a long prayer that she had composed for herself. The prayer recurred to her memory a week later, but slowly; the words sounded "new" to her ears, and it took her several weeks to relearn the whole prayer. This partial amnesia worried her a great deal; and to atone for it she learned numerous other prayers.

Jesus was her tender love; and, as he himself told her in a dream, he was the husband of her soul: "*ich bin ain gemahel diner seel.*" The Savior continually poured into her ears endearing words, erotic sentiments full of carnal significance. After the "sweet" name of Jesus had "sunk" into her heart for the fortieth time she could not so much as place her hand upon her breast without being overcome by a voluptuous sense which spread over her body and diffused into every part. Aware of the sensuous character of her imagined relations with Christ, she heard his seductive voice say to her: "*Ich bin nit ain berauber der sinne, ich bin ain derliukhter (illuminator) der sinne.*" A theological juggler of words would hold up this expression as a classic example of religious beauty and truth.

Her relations with Jesus were not only those of a lover. Through them she also gave vent to her motherly instincts. The child Jesus was her own child. In her hysterical pregnancies she called out his name repeatedly. His name was on her lips on every occasion; she was frequently awakened by him from sleep; she conversed with him; she nursed him at her breast; and she was at times frantic with desire to drink "*sin aller creftigostes minnenwallendex hailiges bluot.*"

The name Jesus, the images and the crosses play the rôle of surrogates for the body of Christ. As has been mentioned, nothing is known about her childhood; and hence, her infantile sex phantasies, repressions and acute psychic traumata are veiled in darkness. But even so, it is clear enough that her religious and hysterical idiosyncrasies are the outward manifestations of her repressed sex impulse. Her devotion to Christ, her saintly piety is the veil under which her erotic nature bursts forth with the pent-up force of a forbidden instinct. Her periodic infirmities, notably her astasia-abasia, set in under pleasurable emotions awakened in her by the presence of God, who always appeared to her in the person of Christ.

In the Freudian sense, an hysterical attack is the vicarious consummation of a sexual act. Margaretha's infirmities betray their erotic meaning and origin by the time at which they occur, no less than by their form and stigmata. Under the mask of religious ardor the mystical nun is better able to abandon herself to her libido phan-

tasies; and she can reach the orgasm better in a prone position. Thus her piety subserves the claims of her erotic nature. The spasmodic contracture of her jaws, to cite another example, occurs just at the time when she is about to take food from the hands of her friend, Heinrich. It indicates the conflict between him and her heavenly lover. Assured by the latter that her relations with him will not be changed by her acceptance of food from the former, her sudden contracture is relieved, and she can eat. Her disgust for food appears only after the food passes through the laryngeal region and into the region of the heart, possibly because it there disturbs the feeling of sweetness and happiness, in the same way in which she feels that ordinary sweets would rob her mouth of the sweet taste of Christ.

The failing of her voice marked the highest crest of her erotic crisis. It set in after some hours of crying, representing sexual indulgences; and she herself compared the hoarseness and the increase of pain, by which it was attended, with the breaking through the ceiling of the flames which had smouldered below; or with the brewing of grape juice which requires a vent before the product may be stilled.

Many of her symptoms are phenomena of identification with her lover: the pains in the heart; the emotional outburst at the reading of the passion story or at the singing of a hymn (*Vexilla Regis*); the broken limbs and body; the characteristic pain in the palms of the hands. In the same way it is suggested that the hypersensitivity, which rendered painful even the slight touch upon her body or limbs, symbolized the Savior's request that Mary Magdalene should not touch him. Her most painful hysterical attack, during which she felt all her bones breaking, and had a strong sense of impending death, occurred on a Good Friday. It represented Christ's sufferings upon the cross. The loss of general bodily sensitivity and the delusion of gliding through space suggest the Ascension of Christ. Even his burial and his lying in the sepulchre were duplicated in her illness, usually after Easter, when for two or three days her body felt hot and cold alternately. Her periods of silence, like the involuntary outcries with which they were usually terminated, bear the marks of their erotic origin in their direct association with the person of Christ. Her visions and her inspirations confirm, in numerous ways, the dual relation of lover and mother which this nun assumed toward Christ.

Many of Margaretha's hysterical phenomena are of a homosexual character: for instance, the orgasm she experienced during the phantasy in which she was sucking "the sweet breasts" of Jesus. She also ascribed to her divine lover a number of female characteristics, —another homosexual trait. It has been pointed out by Freud that the blending of phantasies and wishes which are characteristic of the two sexes are not uncommon in hystericals. And this appears to be true in this instance. There is also an intricate blending of sadistic and masochistic traits in her sexuality. In fact, the polarization of the polymorphous sexual instincts is well-marked in this patient, where, however, the masochistic elements predominate.

When the anarchic whirlwind of antagonistic sex impulses breaks out quite suddenly, Margaretha Ebner becomes a wreck, and her life becomes a long martyrdom. The instincts of womanhood and motherhood had been misunderstood and had been repressed; they break out with pent-up fury and reappear, like the spirits of the barbarian heroes who had been slain in battle, to wage another and

more terrible war. Instead of being taught to recognize and to sublimate their libido into ethically desirable cultural achievements, people are taught to ignore it or to suppress it or to be ashamed of this portion of their racial heritage. The life of Margaretha Ebner, like that of many other religious mystics, fanatics, martyrs and saints, stands out as an example of one of the consequences to which the suppression may lead.

3. S. F. FERENCZI. Anatole France als Analytiker. *Zentralblatt f. Psychoanalyse*, I, 1911. 461-467.

The author points out that Anatole France was as keen a connoisseur of the morbid mind as he was of healthy characters. This gifted French writer usually expressed his psychological views through the medium of the conversations of his literary creations, such as the gentle Abbé Coignard, the genial Monsieur Bergeret, etc. But a *feuilleton* published in the *Paris Temps*, in 1887, describes more directly the views which France held upon the topic of psychiatry. Apart from certain vagaries which are perhaps permissible to one who writes from a literary rather than from a scientific point of view, this paper demonstrates that France's views concerning functional psychosis are very closely akin to those of the modern psychoanalyst. This is shown again, although somewhat more indirectly, in many other passages throughout his literary works. Some of these passages antedate the Freudian literature, and all of them are independent of the Freudian school,—so that, in a certain sense, the new psychological movement may claim him as an illustrious predecessor in the field of *belles lettres*. In this paper France describes a case he had known in childhood, which illustrates the mechanism of psychic repression and its relation to circumscribed amnesia; this shows that France was fully aware of these psychic processes in 1887. The case in question is that of a learned gentleman, a kind-hearted soul, a scholar of high attainments, whose mind was shaken by the drowning of his twenty-year-old only son. His morbid state manifested itself thereafter only in a certain peculiarity of dress. The patient wore a coat of sack-cloth. He presented such a novel appearance that children followed him upon the streets; but his mild demeanor combined with the suggestion of leonine strength in his superb physique always enabled him to keep them at a respectful distance. His first thought upon entering a house was to drape his coat of sack-cloth over the back of a chair with his hat and cane in such fashion as to suggest the figure of a man. He would then examine the figure from a distance, as one might look at a long-lost friend, correct its appearance by re-adjusting the hat or the coat; and when satisfied with the result of his effort, he would leave the figure and devote his undivided attention to his hosts and their other guests. He was wholly rational and his conversation was quite as interesting as it had been before the time when he became obsessed by his idiosyncrasy. His memory was especially good; yet he never spoke of the drowning of his boy. Nor did he even so much as refer to the incident; this great misfortune seemed to have lapsed entirely from his memory.

For twenty years he lived this eccentric life. But one day his neighbors were surprised to see him without his customary coat. He had discarded it, and appeared among his usual haunts clad in an ordinary suit of clothes. It was noted that his disposition had likewise undergone a change. The poor old man had become suddenly

quiet, timorous and sad. The few words he spoke betrayed internal unrest. Bluish spots appeared upon his cheeks; his lips were dark and hung heavily. He refused to eat. A few days afterwards he mentioned his son's name, for the first time since the catastrophe. And the next day he was found, strangled to death, in his room.

So keen an observer of human nature as France did not fail to note the many interesting peculiarities of paranoiacs. It appears that he had a clear insight into their mental mechanism, as is shown by his essay on "Fools in Literature," and by his penetrating analysis of de Maupassant's short stories.

A passage in one of his own short stories, "*Le manuscrit d'un médecin de village*," contains a bit of self-analysis by the hero of the story, which would do honor to a trained psychoanalyst.

The incident is as follows: The village physician is called in to see Eloi, a neighbor's child, whose bright intellect he had admired. In fact, the physician, a typical country practitioner of the old school, felt a keen personal interest in his patients who were at the same time his neighbors and friends. He had remained unmarried, and all the tenderness of his emotional nature went out to his patients. He divided his time between them and his grape vines, in whose growth he took an especial pride. He had been in the act of pruning his vines when he received the call. Straight-way he went to the boy's bedside; and he was very much distressed to find that the little patient was suffering from an attack of meningitis. At the same time he felt a remarkable change in himself. It appeared to him that the child was afar off, so far, indeed, as to appear ridiculously small. Yet it seemed that he had been at the bedside for a long time, as though weeks and months had elapsed since he had been called in.

"I endeavored, as usual," says the hero of the story, "to examine these unusual impressions at once; and I soon saw how the situation came about. I loved little Eloi. To find him, unexpectedly, so seriously ill,—I simply could not bear it. Painful moments appear to us to be fearfully long drawn out. That is the reason why the five or six minutes I stood at Eloi's bedside made such an impression of eternity upon me. As for the vision in which the child appeared to me so far away, it came from the thought that I must lose him. This thought which had formed itself in my mind without any coöperation on my own part, had, from the first, the appearance of absolute certainty."

Other passages from his writings show that Anatole France was as intimately acquainted with the rôle of infantile sex phantasies and repressions in the life of the people as with that of the mechanism of the subconscious.

4. OTTO RANK. Das Verlieren als Symptombhandlung. *Zentralblatt f. Psychoanalyse*, I., 1911. 450-460.

In his "*Psychopathologie des Alltagslebens*," Freud has pointed out that the loss of objects is a symptom which betrays a secret indifference or dislike either for the object or for the person from whom it is obtained or with whom its possession is intimately connected in the mind of the loser. The loss of valuable objects may have one of several meanings of a similar nature. It may express symbolically a repressed wish,—thus serving as a reminder of something pleasurable,—but more frequently it represents a sacrifice to the dark powers of fate, a form of barbaric worship which is not yet dead in our midst.

The present contribution consists of a somewhat detailed analysis of a case in which a girl's loss of various trinkets,—gifts from her betrothed,—illustrates a number of unconscious motivations in the Freudian sense.

5. ALBERT MOHL. *Berühmte Homosexuelle. Grenzfragen des Nerven- und Seelenlebens*, LXXV., 1910. Pp. 80.

The theory that homosexuality is a basal impulse, genetically older than heterosexuality,—together with its corollary that our life is a continuous oscillation between the two instincts,—forms so important a feature of Freudian psychology that a work such as the present, recording with much care the homosexual traits in the life of important personalities of both sexes, is of particular interest to it.

The author refrains from suggesting a psychological explanation of homosexual phenomena. The purpose of his work is rather to describe and to trace the homosexual impulse wherever it shows itself in the records pertaining to the life histories of representative people. This the author has done conscientiously; and he has furnished psychoanalysts with an excellent work of reference.

Mohl holds that the homosexual impulse, even when present in a fairly developed form, does not necessarily lead to nor imply the need of its satisfaction *per viam sexualem*. Accordingly he is disposed to regard such tender friendships as have marked the lives of many excellent men and women, particularly during their adulthood and later years, as longings which are essentially homosexual in their nature. Freudians will doubtless agree with the author in accepting this position. It is assumed, of course, that, for the most part, these subjects were entirely ignorant of the true nature of their tender regard for persons of their own sex. Various writers have traced many of the manifestations of puberty to homosexual tendencies. The present author emphasizes this homosexual origin. He holds, however, that persons who leave such puberty traits behind them in their subsequent development should not be classified among homosexuals. The psychoanalytical view would urge, not that such persons have ceased to be homosexuals, but that their homosexual impulses have been directed into new channels and sublimated into useful activities.

6. H. BERTSCHLINGER. *Heiligungsvorgänge bei Schizophrenen. Allgem. Zeitschr. f. Psychiatrie*, LXVIII., 1911, 209-222.

Dementia praecox may be regarded as being due to the penetration of the subconscious into the conscious sphere of psychic activity. In the healthy person the wishes, instincts and phantasies of the subconscious are held in check. A reduction in the tone of repression may be brought about in a number of ways. Such a reduction is not necessarily a symptom of morbidity; it may occur in a healthy individual, where too the subconscious may emerge, in a moderate degree, as indeed it frequently emerges during exhaustion, during day dreams and especially during sleep. Uncongenial occupation, strong emotional conflicts, excessive repression at critical periods of life,—all of these are conditions which may be responsible for a complete mental breakdown.

Analysis shows that ordinarily the morbid manifestations represent reactions which are due to the subject's unfulfilled or unattainable wishes. Sometimes these wishes are masked under opposite sentiments; at other times they appear in their genuine form, perhaps as attainments which are for the patient as fully endowed with the character of reality as are any of his experiences. The specific symptoms are, in

every case, due to the patient's mode of reaction to the new situation. The course of the disease further discloses a definite series of adjustments whereby the subject endeavors to rationalize his new system of thoughts. The symptoms vary, therefore, with the mode of onset of the breakdown; and the nature of the adjustment that ensues directs the course of the disease.

The adjustment marks the beginning of the recovery,—which latter may come about in various ways. It may result from belated sublimation. Or it may be the effect of a more or less violent process of desymbolization in which either the incongruous mass of subconsciously derived thoughts is brought into accord with the facts of external reality, or the latter are brought into agreement with the former. Again the cure may be effected by means of a "transfer of the complex," although this course more frequently leads to nothing better than a temporary improvement.

Conversions into bodily symptoms are common in hysteria. They are phenomena of adjustment. The author gives the history of four highly instructive cases to illustrate this process in detail.

Sometimes patients evade the complex by suddenly breaking away, as it were, from their morbid system of thoughts. Such patients usually pass into a catatonic state of semi-consciousness, out of which they emerge once more capable of living in the world of reality. The period of illness is encapsulated in a circumscribed amnesia,—the patient's mind reverting back to the time preceding the disease. Several examples of this condition are cited by the author as illustrations.

Occasionally a sudden change in the patient's surroundings, or some striking mental incident may have the effect of arousing the patient, as from a slumber, to a realization of his former self.

Desymbolization has been mentioned as a curative agent. The subject either interprets his world of reality in terms of his morbid fancy; or he readjusts the two by translating the world of his fancy into terms of external experience. A harmless and, at times, insignificant symbol may stand for the fulfilment of the subject's morbid wish, as is the case in dreams.

Of particular interest are the author's descriptions of certain patients who manifested symptoms of paranoidal character, in which their efforts at psychical readjustment were followed by cure. These were, for the most part, highly intelligent patients, not over thirty years of age at the time of their breakdown. Two of them, in particular, showed strong though comparatively recent complexes. The author believes that generally where the outbreak centers around recent complexes, no matter how far back the string of complexes may lead one afterwards, the chances of complete cure are greater than where the condition is directly traceable to very early suppressions.

These are, briefly, the theoretical considerations advanced by the author. The histories of the clinical cases which form the basis of his contribution are very instructive, especially because the clinical material is handled conscientiously. At no point does the author display any desire to force his conclusions or to read far-fetched interpretations into his records. On the contrary, he shows a degree of moderation and reserve which is unusual in these days of zealous partisanship. He does not claim, for instance, that he has gone to the bottom of his cases. He believes we still have much to learn about these conditions before we can understand their etiology or the actual mechanism of their cure. For these reasons he is not disposed to attach too much importance to the therapeutic effect of his intervention, even in those cases where cures were effected.

7. S. FREUD. Formulierung ueber die zwei Prinzipien des psychischen Geschehens. *Sonderabdruck aus dem Jahrbuch für psychoanalytische und psychopathologische Forschungen*, III., 1911, 1-8.

It is probable that every neurosis tends to draw the patient away from the world of reality. This fact was recognized long ago by Janet, who speaks of the loss "*de la fonction du réel*," as a characteristic of neurotics. The Freudian conception throws a flood of light upon the nature, the mechanism and the meaning of this withdrawal.

The neurotic is an individual who is at war with reality: he turns away from it,—at least from that part of it which becomes unbearable to him. Incidents which have brought about hallucinatory psychoses are denied by the patient, who would thus avoid facing the phases of reality which are most unpleasant or painful to him. The Freudian psychology shows by means of psychoanalysis that the unconscious mental processes furnish both the mechanism for withdrawal, and the new world into which the patient retreats. The subconscious represents the older or primary phase of psychic activity; it is a world which is governed wholly by the principle of pleasure-pain. The processes of the subconscious are evolved in a fashion which insures the acquisition of pleasure and the avoidance of pain. Any elements which are capable of arousing algedonic feelings are suppressed. This suppression is carried out fully in the world of phantasy or of dreams, where there is no conflict with reality. It is also attempted in the waking state, which also is dominated by the pleasure-pain principle. But here the suppression often leads to conflicts out of which the individual may not escape unhurt; and we have, as a result, the various forms of psychoses, from the mildest to the most severe disturbances of personality.

The notion that our state of mental tranquility is disturbed first "*durch die gebieterischen Erforderungen der inneren Bedürfnisse*," was worked out by Freud in his "*Traumdeutung*." In the realm of the subconscious the wish is "*halluzinatorisch gesetzt*," as happens daily in our dream thoughts. In the world of reality the expected wish is not fulfilled; repeated disappointments lead to an abandonment of the habit. The hallucinatory road being abandoned, the psychical mechanism now faces, instead, the real conditions in the external world. A new principle of psychic activity is thus introduced, one which is destined to play a preponderant rôle in the activity of rational life. No longer is only that represented which is desirable, but all that is real, even if it be unpleasant.

It may be argued that this schematic division of psychical activity into a period of eutistic satisfaction of the hedonic impulse (to use a word coined by Bleuler) which precedes the period of rational or conscious mental life such as we know it, appears too schematic to be a true representation of facts. Freud himself realizes the daring position he takes here; and in a footnote he endeavors to justify it by quoting some well-known biological facts which seem to render such a view less fanciful,—the embryo of birds, for instance, represents a psychic system such as is here postulated by Freud. Indeed, the psychic mechanism of a bird during the embryonic period, simple as it is, represents an ideal of eutistic life; shut off from the external world, it receives nothing from it except the warmth from the mother's body. It is not dependent upon that world for its food supply,—the prime lever which moves the whole organic world to adjust itself with external nature.

The human nursling may also be said to live in a world of fancy of its own, and to represent such a psychic organization in which wish

and fulfilment succeed each other without the intervention of a harsh external world which demands adjustments and consequent curtailment of wishes.

In its earliest stage, the child probably dreams of the satisfaction of its needs, which are chiefly nutritive, and although it expresses its wants through motor activity, it attains the dreamed-of satisfaction probably without recognizing at first that its motor activity, such as crying, movement of the limbs, etc., is the means by which it attains the fulfilment of its needs. Reality breaks through into the psychic sphere of activity and there becomes a motivating factor of the greatest significance to the life of the individual. Of course the psychic awakening which leads to adjustment with reality is a gradual one; it is attained through a series of gradual adaptations, the particular stages of which are yet to be worked out.

The increasing significance of the external reality accentuates the function of the organs of special sense; the special senses are called into being in response to the organism's need to adapt itself more adequately to the external world. That portion of consciousness which is devoted to an elaboration of the data derived through the senses, in addition to the pleasure-pain categories of thought which dominate it, becomes acquainted also with sense-qualities.

Gradually there is also being established a special function, namely that of attention,—by means of which the external world is periodically explored for data which may be available for the satisfaction of internal needs. "*Diese Tätigkeit*," says Freud, "*geht den Sinneseindrücken entgegen, anstatt ihr Auftreten abzuwarten*." The data which accumulate through this periodic activity of consciousness require some means of preservation; and thus there arises a system of mental markings,—the rudiments of what we call memory. The motor discharge serves to unload the stimuli which accumulate rapidly in the psychic mechanism. At first it serves this purpose through more or less purposeless innervations which are directed inward. But this power is soon turned into utilitarian channels outward, into activities; and, by this means, perceptions of reality are turned to purposive ends.

Thus the maintenance of the motor discharge, or activity (purposeless at first, but soon turned into useful channels), leads to the development of all the higher processes of thought; the material for them is furnished by the continuously accumulating mental representations. At first, thinking was probably a subconscious process only,—at least so long as this function limited itself merely to the relations of the objects which enter into the formation of mental images. It acquires the qualities that lift or "transfer" it to the plane of consciousness "*erst durch die Bindung auf die Wortreste*."

The establishment of the principle of reality does not engage the whole psychic field. There remains somewhere in the psychic mechanism a virgin corner into which reality may not protrude, a distinctly circumscribed field subject only to hedonic motivation. Just as a nation whose wealth accrues chiefly from agriculture reserves a portion of its land in virgin state, so the original psychic function of dream-weaving, which begins with play in children, persists throughout adult life in the form of day dreams. This common tendency of our mental mechanism, Freud calls "*das ökonomische Prinzip der Aufwandsparnis*."

It should not be understood that the transfer from the subconscious to the conscious, and the psychic consequences of this change, occur at one time, or very suddenly, or even in any definite order. The sex

impulses follow a path of their own, characterized by what Freud calls autoerotism and latency.

By the former term Freud refers to the assumption, apparently so vital to psychoanalytical theory, that the sex impulses are at first satisfied auto-somatically (*am eigenen Leib*), and therefore do not appear in the category of the suppressions (*Versagungen*) which are created by the break of reality into the psychic mechanism, as do other wish-dreams. "Latency" refers to the well-known fact that the sex impulses find no outlet before puberty. Until that time they remain under the control of the subconscious (pleasure principle); indeed, in many individuals, sex never escapes from that control.

The peculiar position which the sex sphere of activity occupies with reference to the subconscious domain, with its pleasure motivation on the one hand and with reference to reality on the other, establishes for us a closer relation between the two worlds in which we live and move and have our being, than is recognized by genetic psychology at present. To the psychoanalyst these relations are of capital importance not only for the disentanglement of neurotic disturbances, but also for the understanding of the mental processes of the healthy person. The suppression remains all-powerful in the domain of phantasy. It stifles, for instance, all mental images, *in statu nascendi*, if their establishment in consciousness is likely to be attended by painful experiences. The sex impulse may be kept back from adjustment with reality so long that the retention becomes a fertile ground for the subsequent sprouting of various neurotic disturbances.

There is of course a close parallelism between the pleasure-seeking self and the conscious self. They strive for the same ends,—the former in the contemplative world of wishes, the latter in the active world of reality. Employing terms appropriate for each sphere we may say that the pleasure-seeking self conjures up pleasurable wish-fulfillments and avoids painful ones; the conscious self strives for useful acts and against painful ones. The one is a world of action, the other of phantasy; but the ruling principle is the same in both. Thus, viewed broadly, the change from the contemplative or subconscious world to the active, real world involves no degradation of the hedonic principle. Only its terms of expression, its modalities differ in the two regions. A pleasure of limited duration and of uncertain effect is renounced in the one world in favor of another to be obtained later in new terms, in the other world.

The endo-psychic impression of this transfer has been so strong that it has been symbolized in a special religious myth. Freud regards the story of another world as the mythical projection of this psychic transfer. This transfer does not mean a conquest. Religions have not succeeded in conquering the hedonic principle, which, according to this view, is basal to life; they have only changed its terms of expression.

Education may be viewed as a systematic attempt to conquer the pleasure-seeking self,—to aid in its replacement by the conscious self. The love of the educators should be held forth as the prize to be won; education must fail when children are allowed to feel that they cannot, under any circumstances, lose the love of their elders. Art blends the two principles in a peculiar manner. The artist is a man who at first turns away from reality because he is not in sympathy with its demand that pleasurable instincts shall be renounced; he is an individual who finds means to express his erotic and egotistic wishes in the world of phantasy. From this world of phantasy he finds his way back into the world of reality because, thanks to his special gifts, he moulds his phantasies into forms which are appraised by men as precious repre-

sentations of reality. The artist thus becomes the Hero, King, Creator, Darling, that he wished to become, "*ohne den gewaltigen Umweg über die wirkliche Veränderung der Aussenwelt anzuschlagen.*"

He accomplishes his aim only because all other people share with him the dissatisfaction which prompts him to artistic utterance,—in other words, because the dissatisfaction caused by the inhibition of the sub-conscious domain, through the invasion of the conscious self, is itself a part of reality.

While the self transfers from the subconscious plane to the plane of reality, the sex impulses pass from primitive auto-erotism, through various intermediary stages, to personal love, which leads ultimately to the exercise of the reproductive function. This developmental process may be inhibited at any of its stages; and the point of retardation is where the foundation is laid for the development of neuro-pathogenic disturbances.

8. OSKAR PFISTER. Die psychologische Enträtselung der religiösen Glossolie und der automatischen Kryptographie. *Sonderabdruck aus dem Jahrbuch f. psychoanalytische und psychopathologische Forschungen*, III., 1911, 427-466.

The so-called gift of tongues, for a long time the concern of the theologian because of the connection of the phenomenon with primitive Christianity, has recently become the subject of scientific research. The bibliography appended to Feine's article, "*Zungenrede*," in the *Theologische Realenzyklopädie für Theologie und Kirche* while not exhaustive, is sufficiently lengthy to impress one with the amount of work that has been done upon the subject.

But notwithstanding the labor which has been devoted to this topic, we possess as yet no satisfactory psychical analysis of the phenomenon. The studies are mostly speculative, and rather abstract, because their authors have had little or no opportunity to study the phenomenon by direct observation. F. Godet's assumption that "*die Glossolie ist ein Mittelding zwischen Gesang und Wort, ähnlich dem was wir ein Rezitativ nennen*" is as appropriate as any view that has been proposed thus far; but the actual explanation of the mechanism of glossolalia remains as obscure as ever.

The latest work on the subject (E. Mosiman's "*Das Zungenreden geschichtlich und psychologisch untersucht*," Tübingen, Siebeck, 1911) gives a fairly thorough résumé of previous studies and adds some very suggestive observations. But the latter are based upon impressions gathered rather loosely at meetings of the "gifted-with-tongues;" and hence the author's generalizations lack substantial documentation. The gift of tongues is for Mosiman "*eine Äusserung der Gedanken und der Gefühle durch die Sprachorgane, die temporär unter der Herrschaft der reflexiven Nervenzentren stehen, und die besonderen Formen sind hauptsächlich der Suggestion, die grossenteils aus einer buchstäblicher Auslegung des Neuen Testaments entsteht, zuzuschreiben.*" In the dissociation of consciousness which is brought about by the strong suggestion prevalent at revival meetings, "*vorgestellte Bewegungen zu verwirklichen*," he sees a satisfactory means of explaining religious ecstatic outbreaks, including glossolalia. But this explanation is far from satisfactory. What we need is a systematic study of particular glossolalic phenomena: Only when the results of such an investigation constitute the basis of our comprehensive generalizations may we hope to learn something of real value concerning the psychical mechanism of the phenomenon in question.

It is therefore fortunate that the author of the present contri-

bution has had an opportunity to make a study of cases of the phenomenon. These cases, about six in number, were subjected to psychoanalytical treatment; and the results appear to be a strong confirmation of the Freudian theory, from an unexpected quarter. Here at least we find actual proofs to support the generalizations made and conclusions drawn.¹

Only one of the cases studied is fully reported in this paper. The patient, Simon, was twenty-four years of age at the time of the analysis (1910); he was the eldest child of ignorant parents. His mother had experienced conversion when the boy was six years of age. The child was very pious; he visited the sick in the village and prayed with them. At school he was rather clever in some subjects, particularly in German; but in the higher grades he experienced considerable difficulty in his French, and in certain other subjects. For this reason, the boy was transferred to a lower grade, and he soon became the butt of the jokes and pranks of the younger boys. They called him "*Stundlipfarrer*," on account of his religious mien; and humiliated him in numerous other ways. From the age of fourteen to within two years of the time of examination he was employed regularly in a silk mill, where he advanced from one position to another in due course of time. He had acquaintances among members of different religious sects, but in his sixteenth year, he joined the *Gemeindepfarrer*. He submitted to confirmation one year later. Eight weeks after confirmation, he listened to a pentecostal sermon which impressed him very much; and he also read the passion story of the apostles. Soon afterward while praying fervently, he was surprised to find himself speaking in an unintelligible language. At once it occurred to him that this was the biblical gift of tongues. During the following week he set himself assiduously to the task of exercising his new accomplishment. He also had a very clear hallucinatory vision of the Holy City and at another time, of the Devil; and he heard voices commanding him to do various things.

Upon examination it was an easy task for the analyst to clear up the meaning of these hallucinations because they were nothing more than symbolic representations of the subject's wishes, and convenient means to mask his erotic impulses. The same is true of the religious inspiration experienced by the subject.

But more interesting and wholly novel is the author's analysis of the new language or "tongue." The words of the new tongue were uttered by the subject while fully conscious, and without any special preparation. They fell rapidly from his lips, and were repeated and recorded by the author. This seemingly incongruous mass of nonsense words, when analyzed word by word in the usual Freudian fashion, cleared up as readily as the visual and aural hallucinations; and like the latter they symbolized a long series of wishes and morbid suppressions. Each word, when subsequently repeated to the patient during the course of the examination, aroused half-forgotten memories of childhood, intimate thoughts and wishes, and unpleasant remembrances which the patient had long sought to repress. The results of a number of these examinations were strikingly uniform. Erotic and other phantasies which centered around his former experiences were found to be intermingled, and to break out under the symbolism of hidden phrases. These were, for the most part, distorted words with which the experiences of childhood were in-

¹ Emil Lombard's "*De la glossolalie chez les premiers chrétiens et des phénomènes similaires.*" Paris, 1910.

timately associated. These distorted forms constituted more appropriate symbols, and furnished the semblance of a foreign tongue. In view of the patient's life history and religious experiences, together with his firm belief in his "gift of tongues," it is not surprising that his malady assumed the form of glossolalia.

9. M. WULFF. Beiträge zur infantilen Sexualität. *Zentralblatt f. Psychoanalyse*, II., 1911, 6-17.

Psychoanalysis takes the view that our belief in the child's asexuality belongs to the realm of myths, together with the doctrine of man's primeval innocence and subsequent fall. Sex is not something that comes into play only at puberty. On the contrary, it is present in one form or another from the moment of birth, and it plays an important rôle in every phase of life.

The sex impulse, such as we know it in the adult, is a complex instinct, whose constituent elements undergo a very remarkable evolution during childhood. Only some of these primary elements culminate in the ripening of sex powers at puberty, thus leading to the preservation of the race through the exercise of the reproductive functions; others are directed into various other channels, where they furnish the psychical motive for the production of socially useful activities.

Some of these particular elements which constitute the instinct of sex may be traced as far back as the very first few months of existence. They arise, in fact, in connection with the functions which are basal to life. They are intimately associated, if not identical with, the pleasurable feelings which attend the processes of nutrition, secretion and excretion. The pleasurable sensations aroused about the erogenous zones, mouth, genitalia, etc., during food-taking and excretion are transferred from the infant's own body to external objects, whose contact with these zones is thus capable of arousing the corresponding feelings of pleasure. The signs of this transfer are very numerous in the nursing child. It turns to the nurse or mother as the source of its euphoric satisfaction; the child at the breast is, in fact, not aware at first of any break between itself and the body that nourishes it. That many children cannot be quieted unless they are taken to the breast by their mothers, even when they are not hungry, and after they have been weaned, is a matter of common observation. The warmth of the mother's body, the touch of her warm, soft breast with the infant's hands and lips create a pleasurable sensation. Acquired incidentally, in connection with the satisfaction of the sense of hunger, this pleasure is now craved by the infant for its own sake. It becomes restless and unhappy when deprived of it, even when it has no desire for food. Cases of very small children feigning illness so as to be taken to their mother's breast, after they have learned by experience that they are especially petted when ill, illustrate, perhaps, in a most simple and primitive way how hysterical conditions and similar neurotic phenomena develop around erotic wishes.

The universal over-indulgence of children in tid-bits shows that the intimate relations between libido and the instinct of nutrition persist. In later years the use of alcohol and tobacco replaces this habit in the male; but with woman the love of dainties and tid-bits becomes even greater, and may amount to a passion. The latter may also be the case with adults of both sexes who have remained unsatisfied sexually, and is quite frequently observed in persons who have passed the climacteric period. The intimate relations between the instincts

of nutrition and of sex are richly illustrated in neuroses, psychoses and dreams.

The author joins the extremists who maintain that infantile masturbation is a physiological habit whose function is to develop the external urogenital apparatus into a special sex organ. It arises in infants at a very early period through the sensations around the anal and urethral regions, associated with the functional activity of these parts. The instinct of masturbation is as strong in the infant as it is universal; but it diminishes gradually until about the third year; between the third and the fourth years there is a steep upward swing of the instinct. This is probably the most critical period for the child in every respect, because it is at this time that he is first introduced to the requirements of culture and civilisation; and the infantile impulses and wishes are now repressed by training. The child learns to follow the dictates of the external world more, and those of its own nature less. It cannot have everything that it wishes; and some things in the world, it learns, are not even mentionable. Deeply rooted wishes and phantasies are thus repressed into the subconscious at this critical time in the child's life, and the foundation is laid for the subsequent development of various psychoses and neuroses. Indeed, the first neurotic symptoms which result from the repression,—night frights, urinary incontinence, phobias, and the like,—make their appearance soon afterwards. Infantile amnesia plays a great rôle in later life when the encysted psychic elements break through into the conscious.

The author illustrates these points by briefly citing a few cases of children. Their precocious interest in and their development of sex feelings were perhaps not unusual; but this only adds significance to the author's remark that the child's proneness to onanism is physiological rather than pathological.

10. JAN NELKEN. Ueber schizophrene Wortzerlegungen, *Zentralblatt f. Psychoanalyse*, II., 1911, 1-5.

The psychogenetic meaning of glossosynthesis is an obscure topic of modern psychiatry. The phenomenon is not uncommon. It is frequently recognized in connection with paranoia as consisting in the formation of neologisms. In dementia praecox the glossosynthetic faculty leads to the formation of nonsense-words,—the *Sprachverwirrtheit* of Kraepelin. Although many writers have observed that certain types of insane patients tend to form new words, this symptom remained without an explanation until it was taken up by the psycho-analytical school. In his well-known analysis of a case of paranoid dementia with incoherence of speech, Jung has shown that the patient's apparently senseless stereotyped expressions contained a deep meaning. In the same way, the secondary language of a schizophrenic patient was analyzed by Maeder; and Sachs has also discussed the subject. But above all, the path for all such investigations has been laid down by Freud's own observations on the mechanism of the formation of new words in dreams (*Traumdeutung*), in wit (*Der Witz*), and in the lapses of the daily life (*Psychopathologie des Alltagslebens*).

These studies tend to prove that Kraepelin's surmise that "*bisweilen man die den Wortbildungen sehr deutlich den Einfluss der bestimmten Vorstellungskreise erkennen kann*" is not only justified, but that the newly-formed words *always* relate to the morbid complex of thoughts and may be the means of disclosing its mechanism.

The present contribution deals not with word-formation, but with its opposite, word-splitting and word-derivation by the insane. It is interesting to find that the results obtained in the study of the former phenomenon are confirmed and counterchecked by the results obtained in the latter, thus showing that the psychogenetic mechanism is similar in the two cases.

The author examined a schizophrenic patient who had formed the habit of splitting words in a wholly arbitrary fashion, and of attaching novel meanings to his verbal fragments. Psychoanalysis revealed the fact that the new words attained their meanings symbolically through the medium of the subconscious; there was no discoverable relation, in the patient's consciousness, between the words and their meanings. His insane thoughts revolved chiefly around incest phantasies. Early in the course of his disease he had evolved for himself a grotesque theory concerning the origin of seminal fluid, as a vicarious representation of the incestuous thoughts which he entertained towards his mother and sister. In his insane phantasies he fought against his father who appeared in the form of a goat with the head of an ox. His mother was the queen of heaven, and appeared under different earthly forms, while he, himself, was a primordial god who had fallen from his high estate because he had been seduced by his own daughter. During his frequent warfare the heavenly queen was sometimes on his side, sometimes on the side of the enemy which was led by his father. These conflicts are reflected in the patient's analysis of words. A few examples follow:

I. Milz = Mehl (Flour) + z;

z = last letter; the end.

Mehl = Korn = Corps + n = 2 parallel lines = mating.

Korn = Horn = männliche Rute = Samen

Conclusion: *Spleen is a seminal organ.*

II. The identification of his mother with the queen of heaven suggested to the patient that he should turn to Catholicism. He wrote a letter to the Pope, begging to be taken to the morning service.

Morgengottesdienst

Mor = 1. Rome (reversed);

2. Mohr = black = devil;

gen = gehen;

Gottesdienst = Gott es dient;

Dienst = die + n + s + t;

n = two parallel lines = marriage = my wife and I

s = snake = woman = wife

t = T = Armburst = Pfeil = Amor = Liebe oder Tod

Conclusion: *Der Jungfrau Maria, der Mutter Gottes zu dienen oder dem Teufel zu verfallen.*

This is a sample of the evidence upon which the author bases his conclusion that the tendency of schizophrenics, in their play upon words, is to attach meanings which are suggestive of their inner conflicts to apparently neutral words. Word-formation and word-splitting are a sort of auto-psychoanalysis; they may furnish the careful psychologist with an insight into the nature of the complexes which constitute the basis of the disorder.

 ALFRED BINET


The death of Alfred Binet, which occurred on October 18th, deprives France of one of her foremost psychologists, and will be felt as a heavy loss far beyond the limits of his native country.

Binet was born in Nice, July 8, 1857. In 1871 he went to Paris, with the intention of studying law; soon, however, he came under the influence of Charcot, and turned his thoughts to medicine. About 1880, he decided definitely on a psychological career, and in 1892 was associated with Professor Beaunis in the direction of the laboratory of physiological psychology at the Sorbonne. In 1895, on the retirement of Professor Beaunis, he was given sole charge of the laboratory.

Binet was a prolific writer, with a typically French predilection for the immature, the exceptional, the abnormal, in psychology, and with strong practical interests. His principal works are *La psychologie du raisonnement: Recherches expérimentales par l'hypnotisme* (1886); *Le magnétisme animal*, in collaboration with Ch. Féré (1886); *La perception extérieure*, a memoir crowned by the Academy of Moral and Political Sciences (1887); *Etudes de psychologie expérimentale* (Fetichism in Love, The Psychic Life of Micro-organisms, The Intensity of Mental Images, The Hypnotic Problem, Note on Hysterical Writing: 1888); *Les altérations de la personnalité* (1892); *On Double Consciousness; Experimental Psychological Studies* (1894); *Introduction à la psychologie expérimentale*, with Philippe, Courtier and V. Henri (1894); *Psychologie des grands calculateurs et joueurs d'échecs* (1894); *La fatigue intellectuelle*, with V. Henri (1898); *La suggestibilité* (1900); *L'étude expérimentale de l'intelligence* (1903); *L'âme et le corps* (1905); *Les révélations de l'écriture d'après un contrôle scientifique* (1906); *Les enfants anormaux*, with Simon (1907); *Les idées sur les enfants* (1909). Several of these books have been translated into English, and one at least into German. Binet also published a long list of articles in various magazines, notably in *Mind*, the *Monist*, the *Revue philosophique*, and the *Revue scientifique*. For a year or two he issued, in collaboration with Beaunis, *Bulletins* from the Sorbonne laboratory. In 1895 he began the publication, with Beaunis, of the *Année psychologique*; in 1897 Beaunis resigned the responsible editorship, and the annual has since been carried on by Binet, with the assistance of a changing staff of collaborators. Much of his

work upon applied psychology is contained in these seventeen volumes, and in 1908 Binet formally devoted the *Année* to the study of practical and social questions. In 1897 he founded, with V. Henri, the short-lived but admirably useful *Intermédiaire des biologistes*.

Binet's psychological acumen is best shown, perhaps, in the *Etude expérimentale de l'intelligence*, a study of the intellectual processes of his two little daughters, which he undertook without knowledge of contemporary German work, and which led him to results akin to those obtained by the Würzburg school. On the practical side, he is highly esteemed for the series of mental tests, the first draught of which he published in collaboration with Th. Simon, in 1905. Binet had a dislike of system, and his critical papers are apt to be records of personal impression, set down without regard for perspective. His style tended to prolixity; no doubt, the demands of the *Année* were heavy, and he was often obliged to write when he would have preferred to be silent. He had a large measure of originality and true psychological insight, and he takes rank with the leading psychologists of his generation.



BOOK REVIEWS

Animal Intelligence. By E. L. THORNDIKE. New York, The Macmillan Company. 1911. pp. viii., 297.

Portions of Professor Thorndike's book have already appeared elsewhere; but many pages of new,—not to say novel,—material have been added, and the whole is now presented in a form which is at once more systematic and more readily comprehensible.

The opening chapter discusses the relation of consciousness to behavior, and the possibility of studying consciousness objectively. The author holds that it is quite as legitimate to study consciousness for the purpose of determining what an individual can or will do, as to study behavior in order to determine what mental processes are or may be present; and that psychology may therefore be as independent of introspection as physics is. Nor is there any impassable gulf between physical facts and mental facts, between bodies and minds, between movements and conscious processes. In order to illustrate this continuity of phenomena, the author assumes a case in which one is called upon to learn six things about a given animal,—say, John Smith,—*viz.*: its height, the color of its hair, its toothache, its anxiety, and its thinking of seven-times-nine. The first two items are clearly accessible to objective study. The intensity of the tooth-ache may likewise be determined objectively, by employing certain familiar symptoms as criteria; and the same is true of even such phenomena as anxiety and the processes of thinking. In the latter cases one finds not an absolute inability, on the part of the observer, to tell what John's experience is, but only a greater variability in the observers' estimates; and this variability would be lessened if we possessed a more intimate knowledge of the manifestations of such an experience, and better means of describing, classifying and measuring it. Pain, anxiety and opinions are no more matters of direct consciousness than are height, temperature and color, or than the sun, moon and stars.

The author makes use of this conception of consciousness as a background for his more fundamental hypothesis concerning the relation between consciousness and behavior, and the possibility of obtaining an insight into the nature of the animal mind. Behavior includes consciousness *plus* action. Behavior is therefore raised to a position of supreme importance; and a theory of animal intelligence which is based upon behavior is furnished with a scientific justification.

Chapters II., III., IV. and V. are essentially reprints of the author's well-known papers on *Animal Intelligence*, *Instinctive Reactions of Young Chicks*, *Psychology of Fishes*, and *the Mental Life of Monkeys*. The text in these four chapters is republished in practically unchanged form, although the author confesses that he finds it difficult "to resist the impulse to temper the style . . . with a certain sobriety and restraint" which the exuberance of his youth did not prompt.

The most general law presented in the chapter on *Laws and Hypotheses of Behavior* is that behavior is predictable, *i. e.*, that the same situation will, in the same animal, produce the same response either through original or acquired determinants. All acquired behavior falls

under two laws; first, the Law of Effect, having to do with the degree of comfort or discomfort, and, second, the Law of Exercise, *i. e.*, the law of repetition. All behavior can be explained by one or more of these three laws. In harmony with his former publications, the author definitely denies that imitation can determine behavior. Even in the case of the child's learning to talk, there occur fortuitous sounds in the promiscuous babblings which bring satisfaction in the way of parental caressing. In fact, there is no indication in any activity whatever that the idea of a response, apart from instinctive tendency or former experience, is able to produce that response.

The last chapter deals with the Evolution of the Human Intellect. Since Darwin's discoveries, biologists have worked out a fairly satisfactory physical genealogy of the human race. Much less has been done to find the origin of intellect and to trace its progress up to human faculty. The author holds that all animals manifest fundamentally the same sort of intellectual life; and that human psychology is only higher animal psychology. We must trace out a mental series analogous with the physiological series of the biologists. Then and then only will it be appreciated that "amongst the minds of animals that of man leads, not as a demigod from another planet, but as a king from the same race."

Such, in brief, are Thorndike's problems and conclusions. The book takes rank as one of the classics in this field and is all the more important coming from one who has done so much to introduce the experimental method into comparative psychology. It is only with the view of stimulating helpful criticism that the present review ventures to question any of the author's deductions.

Comparative psychologists would, indeed, deem themselves fortunate if they could assume with Thorndike that introspection adds nothing to our knowledge of behavior. They would then feel less keenly that it behooves them to speak "with a certain sobriety and restraint" in exploiting such inferences regarding the nature of the animal mind as they may draw from their observations of animal behavior. But the current literature of comparative psychology voices so many discordant and apparently irreconcilable views that the modern reader is no longer shocked by a theory which subordinates consciousness to behavior. It will probably turn out that psychologists will refuse to endorse this conception of consciousness,—a conception which is neither a natural nor a necessary consequence of the observed facts upon which its author bases it. Indeed, the view of consciousness which is here presented seems to be designed more to justify a procedure than to explain the findings obtained by that procedure.

In regard to his laws of behavior, one is immediately confronted by the problem as to how they will explain concrete cases. Learning to talk is not a good example of imitation. Most psychologists will agree with the author that skill in talking comes through trial and success. What of the numerous cases of reactions which seem to spring full grown from a single immediate situation and which still manifest themselves in terms of the situation? Even though we take the author's estimate of one in ten of this character we have an enormous number of reactions to account for. Must we, in such cases, seek phylogenetically for the basis of an instinct, or ontogenetically for a former experience? Learning to talk is not even typical of many forms of activity which must be explained, although the author gives almost entire emphasis to this one activity and makes little effort to classify others under his laws. The argument that the idea of an act cannot produce the act might be met by the equally demonstrable argument

that the idea of an act is impossible until the reflex physiological component is established. Thought is predominantly motor; and this is especially true of any thought which would raise the question of imitation. Thorndike may deny that a causal relation exists between the idea and the reaction; but it may still be that there is concomitance between the two, outside of experience. The doctrine of psychophysical parallelism is disregarded in the author's assumption without being either disproved or denied. The reviewer finds an apparent inconsistency between certain statements which are fundamental to Thorndike's general position. How is one to reconcile "the same situation will, in the same animal, produce the same response" (p. 341) with "of several responses made to the same situation" (p. 244)? How will these appear in the light of his principle of abstraction (p. 263)? How can all of these views be brought into relation with his definition of "situation" (p. 283)? What is there in the author's generalized Law of Effect (p. 244) which is not circular with his definitions of satisfying and discomforting (p. 245)?

The last chapter is well written and presents a probable psychology of the future. The author ventures to outline how comparative psychology may come to hold the same relation to the psychology of consciousness that biology now holds to physiology. No one now before the public is better fitted by training and experience to arrange this psychic series than the man who has taken the lead in so many other lines of research. Let us hope that Thorndike will find it possible to amplify his last chapter into a companion book in the *Animal Behavior Series*.
L. W. SACKETT.

Clark University.

A Text-Book of Experimental Psychology with Laboratory Exercises.

By C. S. MYERS. Second edition. Cambridge, The University Press; New York, Longmans Green & Co., 1911. Part I, Text-book. pp. xiv., 344. Part II., Laboratory Exercises. pp. ii., 107.

Dr. Myers' Text-book was noticed in this JOURNAL, xx., 462, on its appearance. It has now attained a second edition—a matter of congratulation both to the author and to his countrymen; and it has been issued, wisely, in two parts.

I find little change in the Laboratory Exercises: an experiment on after-sensations of hearing has been removed, and two experiments on labyrinthine sensations have been added. The text of Part I. has been revised throughout. The most striking additions are the references to Head's 1911 *Croonian Lectures*, which appear in ch. ii. (Cutaneous and Visceral Sensations), xvi. (Muscular Effort), xvii. (Local Signature), xviii. (Sensibility and Sensory Acuity), xix. (Identity and Difference), and xxiv. (Feeling), and the new chapter on Thought and Volition. In the latter, Dr. Myers discusses the question of imageless thought. I am not sure that I understand him; but I will give what account I can of his position.

(1) There is, first of all, the matter of 'act' and 'content.' Dr. Myers believes that the 'act' is introspectively separable from the 'content' in such experiences as perceiving, imagining, attending, thinking, desiring, reasoning, but that it does not show specific differences; always what is left, when contents are removed, is "the conative experience of mental activity." In the case of thought, the separation of 'act' from 'content' is most easily made when (possibly is dependent on the circumstance that) there is difficulty or obstruction in the course of thinking.

(2) The 'object' or 'content' of thought is often imageless. In the race, meaning is prior to thought; and in the individual (in the rudimentary thought of the infant) thought is prior to language. Hence, while imagery and language are necessary for the growth of mind, it is not surprising that we, with this growth behind us, should, especially in abstract or unimpeded thought, employ a "short cut or abbreviation" whose final result is "mere awareness." To do this is, after all, only to discard the elaborate machinery of words and images for a more primitive tool of consciousness; though the tool has, of course, been formed and sharpened under the influence of mental development at large. As for the mechanism of awareness, "the probability is that we come to construct for ourselves various 'schemata,' as Head calls them, *i. e.*, systems of unconscious dispositions," upon the basis of which presentations are apprehended; thus we apprehend size under the unconscious influence of a schema of distance; and there are similar schemata for meaning, and for other spatial, as well as for temporal and logical relations. 'Mere awareness' would then, I suppose, stand for the lowest conscious terms in which a situation can be assimilated to a schema.

(3) Above both act and content of the thought stands a directive awareness: a knowledge, *e. g.*, of whether and how one can solve a given problem. "This need not be present in the form of a thought content;" that is to say, if I understand the author, it may exist simply as an unconscious schema.—

The index to both Parts is appended to Pt. I., so that the user of Pt. II. must turn for his references to the companion volume. This arrangement is a mistake. The author should also know better than to refer to Stout's "Analytical Psychology."

E. B. T.

The Philosophy of Music: a comparative investigation into the principles of musical aesthetics. By H. H. BRITAN. New York, Longmans Green & Co. 1911. pp. xiv., 252.

The problem of a 'philosophy of music' is threefold. It has, first, "to determine as clearly and as accurately as possible the nature of the psychological processes involved in the musical experience." This psychological analysis is imperative: for little systematic work of the kind has yet been done; the mental reactions are so subtle and intangible that superficial work upon them leads to exaggeration and vague generalities; and only through psychology can music be related to other manifestations of human thought and action; the principles of musical criticism, *e. g.*, are in the last resort psychologically grounded. The philosophy of music has, secondly, to consider the relation of music, not only to other arts, but also to morality, religion, education. And it has, thirdly, to face the ontological question, and to discover "what is the essential, irreducible content when analysis has reduced the subject to its lowest terms." After an introductory chapter on Musical Form, these three problems are taken up. A 'Psychological Analysis of the Elements of Music' treats of the first,—of the psychology of rhythm, melody, harmony, musical expression; and a 'Philosophy of Music' treats of the other two,—of the universality, versatility and power of music, the content of music, musical criticism, and the educational value of music.

The book has evidently been written *con amore*, and there are parts of it that I have read with interest. I am also unreservedly on the side of any author who seeks to train the musical intelligence and heighten the musical feeling of his time. On the other hand, it is impossible to

grant that the present writer has proved adequate to his task. "While the bibliography of music is voluminous," he tells us, "attempts at a scientific psychological analysis of music, and at a systematic discussion of the principles of musical aesthetics are surprisingly few." Let this be admitted: is there, then, not all the more reason to utilise what we have? And Professor Britan has apparently failed to find—at any rate he has not utilised—Stumpf, or Lipps, or Wundt's volume on Art, or Wallaschek, or Riemann, or Siebeck, or Moos, or indeed anybody of that ilk except Hanslick, to say nothing of the magazine-writers! The omissions are astonishing. And when Hanslick is introduced, his name merely points the difference between 'formalists' and 'expressionists'; why there should be such a difference, or how it originated historically, the reader may think out for himself; that Hanslick stands over against Hauptmann, with Schopenhauer and the evolutionists between, he must learn from other sources. As to the content of music, it has two elements: the sensuous qualities of musical sound, which arouse direct sense-feeling, and musical thought, which arouses an intellectual activity whereby the purest and richest aesthetic emotion is gained. "To explain why such intellectual activity should give pleasure, we shall refer, in lieu of a better one, to the biological theory of pleasure and its function."

E. B. T.

Laughter; an essay on the meaning of the comic. By H. BERGSON.
Translated by C. BRERETON and F. ROTHWELL. New York, The Macmillan Co., 1911. pp. vi., 200. Price \$1.25 net.

Bergson's theory of the comic has now been before the world for some dozen years, and is probably familiar to the readers of this JOURNAL. All modes of human life, he says,—individual selfhood, society, language,—are in their proper nature supple and elastic, alert and active, ever moving and never repeating, irreversible, unique. But there is always the danger of rigidity, of automatism. Whenever, then, we find in human thoughts, words, actions, affairs, anything inert, mechanical, repeatable, stereotyped, we instinctively recognise it as non-adaptive and as requiring correction. Laughter is the social gesture whereby this correction is administered; it implies a certain callousness and indifference, even a touch of malice in the laughter. The sphere of the comic is a sort of neutral zone, beyond the region of emotion and struggle, in which a man's interest in his neighbour is predominantly an interest of simple curiosity, but in which, nevertheless, a sharp lookout is kept for anything that threatens the desirable maximum of elasticity and sociability. Comedy is, therefore, not life; neither is it art; for art is individualistic, its sole object being 'to brush aside the utilitarian symbols, the conventional and socially accepted generalities, in short, everything that veils reality from us, in order to bring us face to face with reality itself;' while comedy looks outward, seeks the similar and the typical. It is not life, while yet it pursues the utilitarian aim of social improvement; it is not art, while yet it comes into being when society and the individual, freed from the anxieties of self-preservation, begin to regard themselves as works of art; it lies, in fact, midway between art and life.

On these principles, Bergson accounts for the whole of the comedian's stock in trade, from the portly gentleman's slip on the orange peel to the cross purposes of Mr. Dale's visit to Patterne Hall. The theory has been assimilated, whole or part, by Lippsians and Freudians, and has been variously criticised by the independents;

all acknowledge the freshness of its outlook, the acumen with which it is worked out, the charm of its presentation; the work has reached a seventh edition in France, and translations are many. The English version, which lies before us, is accurate and readable; its style improves—unless one is misled by the growing interest of the subject?—as the book proceeds. At any rate, it is in the early pages that I have noted inelegancies. "The formula exists well enough in a certain sense," "We might think of an immense avenue such as are to be seen in the forest," are sentences occurring in a single paragraph; "We must distinctly perceive, as though through a glass, a set-up mechanism," "A contemporary philosopher, an out-and-out arguer," are hardly model phrases; 'delimitate' is unnecessary, and 'Iéna' is not English. There is no index. E. B. T.

The Psychology of Education. J. WELTON. Macmillan & Co., Ltd. London, 1911. pp. 507.

In the author's words, "This book is a systematic treatise neither on psychology nor on education." It is intended rather to help teachers to form a practical psychology. All teachers, of course, have some such working theory, but they will be helped, the author thinks, by "generalisations from an experience wider than that of any individual educator, but of the same kind as those which each real educator makes." The teacher is advised that the psychology of value to him, that is, an understanding of the desires, plans, and thoughts of the child, is to be gained chiefly by observing the conduct of those in his charge, and by interpreting it in the light of his own conduct and his own experience, as known by introspection and especially by remote retrospection. The book, then, is a collection of such generalisations, under the chapter-headings: "Education and Psychology," "The Study of Mental Life," "Bodily Endowment," "General Mental Endowment," "Variations in Mental Endowment," "Nature of Experience," "Development of Interests," "Direction of Activity," "Learning by Direct Experience," "Learning through Communicated Experience," "Critical Thought," "Ideals," "Character." It is written at a common-sense level, and fails generally to consider technical and experimental work. W. S. FOSTER.

The Essentials of Mental Measurement. WILLIAM BROWN. The University Press, Cambridge, 1911. pp. 154.

The book is valuable to students in psychology and education as a careful and exceptionally concise presentation of quantitative theory, admirably supplemented by illustrations of its use and results in practice. Part I is a résumé of the general theory of mental measurement, with a description and comparison of the psychophysical methods. Part II deals with correlation. There is a discussion of its general meaning and use, and a clean-cut chapter on mathematical theory. Then follow a review and evaluation of the methods and treatment of data in historical investigations involving correlations. The author gives an account of a previously published investigation of his own, involving the correlation of mental abilities, and then discusses the significance of correlation for psychology in general, outlining the bounds of its usefulness. One is glad to note the emphasis the author puts upon the fact that, in measuring and comparing mental traits, psychology and method come first, mathematics and treatment of data afterward. W. S. FOSTER.

Scientific Mental Healing. H. ADDINGTON BRUCE. Little Brown & Co., Boston, 1911. pp. 258.

The book is a collection of eight essays, slightly revised from their original form of magazine articles. It treats of the evolution of mental healing, the history and methods of various schools of psychopathology (Janet, Freud, Sidis, Prince), of Christian Science and New Thought, discusses hypnotism and secondary selves, touches upon the applications of psychology to education, law and advertising, and adds a chapter on psychical research, and an appreciation of William James. The treatment throughout is of the 'popular' sort—anecdotal, sketchy and superficial.

W. S. FOSTER.

Experiments on the Generation of Insects. By FRANCISCO REDI of Arezzo. Translated from the Italian edition of 1688 by M. BIGELOW. Chicago, Open Court Publishing Co., 1909. pp. 160.

Intracellular Pangenesis; including a paper on Fertilization and Hybridization. By H. de VRIES. Translated by C. S. GAGER. Chicago, Open Court Publishing Co., 1910. pp. xiii., 270.

Some Neglected Factors in Evolution. By H. M. BERNARD. Edited by M. BERNARD. New York and London, G. P. Putnam's Sons. 1911. pp. xxi., 489.

Mendelism. By R. C. PUNNETT. Third edition, rewritten and enlarged. New York, The Macmillan Co., 1911. pp. xiii., 192.

The Open Court Publishing Company has made all students of life and mind its permanent debtors by the series of reprints and translations, two volumes of which lie before us. Redi was the first to disprove, by experiment, the generation of living things from dead matter; he is thus the pioneer on the road that led to the theory of biogenesis. Unfortunately, his observations on galls misled him, and he thought that 'the peculiar potency of that soul or principle' which gives rise to flower and fruit also engenders the worms in the galls. The translation is competent; it is, however, to be regretted that the work was not annotated by a biologist.

The *Intracellular Pangenesis* appeared in German in 1889; the paper on *Fertilization* dates from 1903. As Professor Strasburger remarks in an Introductory Note, no 'recommendation' of Professor de Vries' works is needed; they are consulted of necessity by all who are interested in the topics which they discuss. The translator, Professor Gager of the University of Missouri, contributes an interesting Preface.

The late Mr. Bernard is known by his papers in systematic zoology and by his work on the histology of the retina. In the present volume he gives us his general views of the course of organic evolution. Pt. i., *The Protomitotic Network*, outlines a theory of morphogenesis. The precellular unit of living structure is the chromidium, a particle of chromatin from which radiate delicate linin-filaments, and which is set in a fluid albuminous matrix to the surface of which the filaments extend. From the chromidium develops the cell, and from the cell develop in like manner individuals of a higher order; the linin-filaments persist as a continuum throughout the entire organism, and the chromatin collects at the nodes of the network to form nuclei. This theory leads the author to conceptions of histogenesis, ontogenesis and phylogenesis which, in many respects, differ widely from the ideas currently accepted. Pt. ii., *The Cosmic Rhythm*, argues that we can distinguish five great evolutionary periods, each one intro-

duced by a unit resulting from the colony-formation of the unit of the preceding period. The units are the chromidial, the cellular, the gastraeal, the annelidian, and the simian or anthropoid. At all stages there is continuity of structure, secured by the linin-filaments; the successive colony-formations are true structural integrations. When, however, we come to man, we reach the limit of this morphological integration; human societies or colonies are made up of separate colony-units, of separate men and women. Yet the principle remains the same; for the essential factors in the evolutionary process are the stimuli transmitted by the network; and if we can find transmission of stimuli between the members of human society, we have a right to speak of social integration. Now such transmission occurs, indirectly, by speech and gesture; but it also takes place directly, by telepathy; "on the failure of the primitive linin-network to embrace and tie the human aggregates together, the psychic counterparts of the nerve energies have become the chief factor in connecting the units." So we are necessarily led to consider the part played by the psyche in organic evolution; and the author concludes that it "does not take part in the actual machinery as any primary essential part of the mechanism, but, as the machinery becomes complicated, it plays an important part in simply heightening or dampening down the stimulus." At the same time, the psyche, having emerged, fills a larger and larger portion of man's life, and the life of the future will probably be "the result of the interplay of the specially developed psychic organism with a psychic environment." Even, then, if further morphological transformation is impossible, we have every reason to think that a sixth period will start on a higher level of life, altogether beyond our present comprehension.

It is something of a relief to turn from these highly speculative discussions to the inductions and experiments of Professor Punnett's *Mendelism*. The book, which is written in a style as popular as the subject allows, consists of fifteen chapters: the Problem, Historical, Mendel's Work, the Presence and Absence Theory, Interaction of Factors, Reversion, Dominance, Wild Forms and Domestic Varieties, Repulsion and Coupling of Factors, Sex, Intermediates, Variation and Evolution, Economical, Man. The treatment offers, if compared with Mr. Bernard's work, a good illustration of the difference between hypothesis and speculation. The *Mendelism* may be cordially recommended, as an admirable introduction to the present problems of heredity: aside from a slip in botanical nomenclature (p. 2 and elsewhere), there is little if anything for the critic to carp at. The final chapter, with its remark that "the analysis of mental characters will no doubt be very difficult," is a direct challenge to the experimental psychologist.

On Certain Electrical Processes in the Human Body and their Relation to Emotional Reactions. By F. L. WELLS and A. FORBES.

An Empirical Study of Certain Tests for Individual Differences. By M. T. WHITLEY.

Archives of Psychology, nos 16, 19. New York. The Science Press. 1911. pp. 39; iii., 146.

Both of these Studies contribute to our knowledge of problems that are at present under general discussion. The work of Messrs. Wells and Forbes appears almost at the same time with that of Radecki in the *Archives de Psychologie*; and it is reassuring to find a substantial

agreement in results. Wells and Forbes refer the psychophysical galvanic reflex to "the secretion of sweat, which manifests itself physically in two ways, by changing the electrical potential of the surface of the body and by lowering the resistance of the skin." Radecki finds, similarly, a change of potential at the surface and an increased conductivity of the body as a whole; he refers the former to secretory, the latter to circulatory changes; but he adds that the two physiological processes are interdependent, to the extent that each one may be the indirect cause of a physical phenomenon depending directly on the other. Wells and Forbes say that "as an objective criterion of emotional reaction, the electrical reflex appears distinctly superior to any analogous procedure as yet developed;" they add, however, that variations in the susceptibility of a given individual at different times are hardly less than those between different individuals. Radecki also concludes that the reflex is the most delicate test of the emotive factor in mental processes as yet discovered; and he appends a like qualification, though the conditions of his work lead him merely to restrict the application of the test to the individual. It is clear, then, that we are well on the way towards an understanding of the reflex and that, with the improved methods and instruments now becoming available, we may hope to secure a reliable objective index of the presence of affective processes in consciousness.

Miss Whitley reports 45 tests on 3 to 7 subjects, discussed with a view to correlation, change under brief practice, and reliability of the single trial; and 5 very different tests on 9 subjects, discussed from the point of view of change by practice (of the adequacy of 'mean curves' for tests and for persons subjected to them). On the basis of these results, she considers a number of objections raised against various modes of test-procedure. (1) 'A simple test tells us very little of its subject.' But descriptive notes may be taken during performance, and careful selection will render even a simple test significant. (2) 'A single trial is unreliable.' True: not only because of its singleness, but also because of other, variable factors. Few tests frequently administered give the best estimate of the individual and the best basis for comparison. (3) 'The result of the first few trials measures, not the function under test, but adaptability to novel conditions.' The objection is not of weight. (4) 'Tests measure previous similar experience rather than actual capacity.' But this holds of all mental measurement; and the inference is, simply, that tests should be repeated at stated intervals. (5) 'Results are misleading.' True, if only one form of measurement is employed; not if the measurements are treated in various possible ways. (6) 'Practice is individual, both for person and for process tested.' But there is a general law of improvement; and characteristic variability or consistency of performance is precisely what the tests will disclose.

L'Analyse physiologique de la perception. Par E. ABRAMOWSKI. Collection de psychologie expérimentale et de métapsychie, xx. Paris, Bloud et Cie. 1911. pp. 120.

Every 'state of consciousness,' the author tells us, is correlated with 'a group of active physiological elements, nervous and other.' Thus the unitary 'state of consciousness' that we call the visual perception of an object is correlated with a group of sensorial elements, peripheral, subcortical and cortical, whose activity conditions the externalised totality of sensible qualities; a group of mnemonic elements in the frontal lobes, which give recognition, make the object par-

ticular; a group of coenaesthetic elements, which add affective tone; and a group of elements simultaneously excited through other sense-organs, which bring no consciousness of their own, but nevertheless influence our experience (*manière de sentir*) of the conscious perception. By the excitatory effect of group upon neighboring group, and the inhibitory effect of new upon precedent activity, four kinds of change take place in the physiological correlate: a new group is associated to a pre-existing group (subjective variation in perception, judgment); part of a group remains active, while the remaining part lapses from function (dysgnosia, resulting from fatigue of attention); part of a group lapses, while the remaining part is associated to a new group (association of ideas); and the association of a new group arrests the function of the pre-existing group (sudden emotion, suggestion). Furthermore, all nervous activity is reducible to a nutritive reaction. And as this metabolic process extends beyond the nervous system to other tissues, the entire organism divides, at a given conscious moment, into a part that is living or active, and a part that is dormant or inactive; so that, in the wider sense, the whole of the 'living' part is the correlate of consciousness. What this living part is, in detail, must be made out by application of the method of concomitant variations.—

The author is, no doubt, right in his insistence upon the very great complexity of the neural counterpart of such a process as perception. He does good service, also, in calling attention to the peculiar change in perception that results from change of mood; things do seem actually to 'look brighter,' to assume a greater luminosity and a more vivid coloring, when we are, *e. g.*, joyfully expectant. On the other hand, his underlying doctrine of assimilation and dissimilation, his theory of feeling, and his classification of mental processes, are all open to criticism; too little is known, whether of nervous system or of mind, for such theorising to command acceptance.

Handbook of American Indian Languages. By F. BOAS. Part I. Washington, Govt. Printing Office. 1911. pp. vii., 1069. Bureau of American Ethnology, Bulletin 40, pt. i.

Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico. By J. R. SWANTON. Washington, Govt. Printing Office. 1911. pp. vii., 387. Bulletin 43.

Indian Languages of Mexico and Central America and their Geographical Distribution. By C. THOMAS, assisted by J. R. SWANTON. Washington, Govt. Printing Office. 1911. pp. vii., 108. Bulletin 44.

Preliminary Report on a Visit to the Navaho National Monument, Arizona. By J. W. FEWKES. Washington, Govt. Printing Office. 1911. pp. vii., 35. Bulletin 50.

Antiquities of the Mesa Verde National Park: Cliff Palace. By J. W. FEWKES. Washington, Govt. Printing Office. 1911. pp. 82. Bulletin 51.

The first work upon this list had its inception in an attempt to prepare a revised edition of the Introduction to the Study of Indian Languages by the late Major J. W. Powell. The present volume contains sketches, by competent hands, of ten languages of the northern group: the Athapascan, Tlingit, Haida, Tsimshian, Kwakiutl, Chinook, Maidu, Algonquian, Siouan and Eskimo. The Introduction, by Professor Boas, discusses Race and Language, the Characteristics of Language,

Classification of Languages, Linguistics and Ethnology, and Characteristics of American Languages. The intention of the whole is to "describe as clearly as possible those psychological principles of each language which may be isolated by an analysis of grammatical forms," and a full discussion of "the essential psychological characteristics of American languages" is promised for the end of the second volume. Whether this selectively psychological treatment will be of greater service to psychology than a complete linguistic exposition, an objective record which every psychologist might use independently for himself, remains to be seen. If, however, it is allowable to judge by the material before us, enough will be offered to afford a critical basis whether for agreement or for dissent. It is impossible to praise too highly the care with which the book has been compiled and printed.

The greater part of Dr. Swanton's work is devoted to the Natchez group, and contains valuable information as to customs, mythology, and religion. It is interesting to note the settlement, by new evidence, of the controversy regarding the Taënsa grammar which raged in the eighties of the last century. "If the language in the work under discussion was ever a living speech it was not that of the Taënsa; and since, in consequence, the texts, containing as they do references to this tribe, must have been the work of white men, we may conclude with probability that the whole of the material had the same origin and is entirely fraudulent" (p. 24).

Drs. Thomas and Swanton have prepared a linguistic map of Mexico and Central America, which has been revised by a number of authorities, and is here printed "as an attempt to represent the present state of knowledge regarding a subject which may never be cleared entirely of obscurity." The two remaining *Bulletins* upon our list are of an archaeological character.

The Conflict of Naturalism with Humanism. By W. GOODSSELL. *Spinoza as Educator.* By W. L. RABENORT. Teachers' College, Columbia University. Contributions to Education, Nos. 33, 38. 1910, 1911. pp. 183, 87.

For Humanism, the significance and worth of the universe rest in their relation to the life of man; for Naturalism, human life, as well as all phenomena that penetrate man's experience, are explicable by reference to natural forces, operating throughout the universe to produce unvarying sequences of events. These world-attitudes were clearly outlined by the Greeks; re-emerged during the intellectual ferment of the Renaissance; attained a clearer definition in the 17th and 18th centuries; and are found in conscious opposition in the 19th. They may be reconciled by way of Pragmatism, "a philosophy of life which combines the devotion to facts characteristic of the naturalist with that reverent faith in ideal values which marks the humanistic creed." Mr. Goodsell's essay traces the historical development of the opposing theories; shows the influence of their opposition upon the educational theory and practice of different periods; outlines the pragmatic reconciliation; and suggests the implications of this pragmatic synthesis for a philosophy and art of education. He has read widely, but makes no reference to Ward's 'Naturalism and Agnosticism'.

Spinoza looked upon education as a natural process, since it is in harmony with the developing character of the universe; as a necessary phenomenon, since God and Nature would be different without it; and as a free activity, since it goes on in accordance with the

nature of the being educated. The possibility of education thus granted, Mr. Rabenort shows us Spinoza's view of the elements of human nature, and sets forth his doctrine of the supremacy of the intellect. The author then turns to the complications of personality; individuals differ, and individuals also unite to form social groups. So we arrive at the criteria of education; Spinoza accords priority to social intercourse and the preservation of life and health. The general aim of the essay is to prove, by exposition and full quotation, that the omission of Spinoza's name from the roll of philosophers who figure in the History of Education is unjustified; the author hopes that, the hint once given, the bearing of the Spinozistic philosophy upon education will attract the labor of other hands.

"Obscene" Literature and Constitutional Law: a forensic defense of freedom of the press. By T. SCHROEDER. Privately printed for forensic uses. New York, 1911. pp. 439.

The Social Evil in Chicago: a study of existing conditions with recommendations by the Vice Commission of Chicago. Chicago, Gunthorp-Warren Printing Co., 1911. pp. iii., 399.

Report of the Vice Commission of Minneapolis to His Honor J. C. Haynes, Mayor. Minneapolis, Press of H. M. Hall, 1911. pp. 134.

The Answer. By W. J. CHIDLEY. Melbourne, The Australasian Authors' Agency. 1911. pp. 79.

The first of these volumes, which consists in the main of articles already printed in popular, medical and legal journals, argues, as its title implies, that the existing postal and other laws against 'obscene and indecent' literature are unconstitutional, and that the resulting suppression of information is contrary to public welfare. Its subject-matter is therefore of sociological rather than of psychological interest; we note, however, that it contains a psychological and ethnological discussion of Modesty, the results of which are in substantial agreement with those of the best modern authorities.

The next two books,—the one of them was at one time forbidden the mails; so that, in its case at any rate, Mr. Schroeder's protest is justified and timely,—are also sociological in character; the Chicago Report contains data of some importance for social psychology.

The question which Mr. Chidley seeks to answer is that propounded by Montaigne: "What has rendered the act of generation, an act so natural, so necessary and so just, a thing not to be spoken of without blushing, and to be excluded from all polite discourse?" The answer, freed of all irrelevancies, is this: The act has been misunderstood, popularly and scientifically. The author's view is a physiological, not a psychological hypothesis; we give it mention because he declares that for many years he sought, in vain, to publish a book on the subject. We suspect that the failure to find a publisher is due less to the nature of the subject itself than to the apparently extravagant theories and inferences with which Mr. Chidley invests it.

An Outline of Individual Study. By G. E. PARTRIDGE. New York, Sturgis & Walton Co., 1910. pp. v., 240.

This little book suffers from two disadvantages: the first, that it appeared in the same year with Whipple's far more elaborate *Manual of Mental and Physical Tests*; the second, that it bears a curiously

misleading title. To those who know beforehand nothing of its contents it must suggest an outline for self-education, a sort of correspondence-course in book form; to those who are acquainted with its purpose, it must suggest a comparison with Whipple's larger work. For it is, in fact, not an outline of individual study, but an outline of the study of individuality, a guide to the teacher who wishes to acquire a sympathetic and intelligent understanding of the character, temperament, and latent possibilities of the pupil. Its aim is thus more general and its treatment more elementary than those of Whipple; it may be used in schools that do not yet possess the equipment for a formal course in mental and physical tests; even where such a course is given, it may serve, as collateral reading, to give a broad perspective; and it will be of real aid to the Normal School graduate who is called upon to conduct, with small means and with less experience, a first examination of the children under her care.

Pt. i., on the history and theory of individual study (i. e., study of individuals), is of minor importance. Pt. ii., on the practical study of individuals, and Pt. iii., on the application and results of individual study, are the really useful portions of the work. The topics discussed are health, bodily characters, measurements of the body, movements, mental traits, emotions, interests and instincts, senses and perception, memory and association, free mental activity (imagination), and purposive thinking; there follows a statement of the results obtained by the application of the methods described to two children, identical twins, brought up in the same surroundings, but grossly differentiated by the fact that the one had suffered an attack of brain fever.

A valuable feature of the book is the vocabulary of terms denoting mental traits (pp. 106-111, 118).

Justice and Happiness. By W. BENETT. Oxford, The Clarendon Press. 1911. pp. 140.

The first of the two essays which make up this little volume is concerned with the definition of Justice, and the application of the concept as defined to various social problems. All justice, the author finds, is either retributive or distributive, and the guiding principles under both heads are personal equality, and desert or equality of value. In retributive justice, rewards and punishments are governed entirely by desert, and the position of the parties before the law, by personal equality. Distributive justice is a compromise between equality of persons and equality of deserts; perhaps, more correctly (in view of the way in which the original principle of equality of desert has been obscured by history), between personal equality and personal inequality. Genetically, justice, like the social habit itself, is an immediate product of the necessities of man's position in the world; it has its root in prehuman instincts. Justice owes its steady pre-eminence among ethical values to the fact that it is by far the most important condition of freedom; and freedom may be defined as the political and social conditions which secure the greatest possible evolution of power towards the realisation of a national end, which is also ethically valuable.

From Justice the author passes to Happiness. Justice is the primary condition, not of happiness generally, but of all that makes happiness worth having; for Justice necessarily conditions freedom, freedom conditions forward evolution, and forward evolution determines the ethical value of happiness. After a psychological char-

acterisation of happiness, and a negative discussion of its intrinsic ethical value, we proceed to the question whether the pursuit of happiness, for oneself or for others, has ethical value. The outcome is again negative: "we never find happiness as a feature of any one of the concrete ideals which men set up for their reverence." In general, the end of action and the object of desire, in conduct which has an ethical value, are always distinct; the end of action is something which, in itself, is neither desirable nor undesirable; and the more completely the distinction is carried out, the higher is the value of the action.

Zur Lehre vom Gemüt. Von J. REHMKE. Zweite, durchgearbeitete Auflage. Leipzig, Dürr'sche Buchhandlung. 1911. pp. viii., 115. Price Mk. 3.00.

Professor Rehmke here outlines his systematic psychology of Feeling. Freed from the technicalities of his *Lehrbuch*, the doctrine is substantially as follows: Feeling is subjective (*zuständlich*) as opposed to presentation which is objective (*gegenständlich*), though it never appears without objective accompaniment. It is determined by the whole group of presentations, clear or obscure, that constitute the objectivity of a particular consciousness; its mode, as pleasant or unpleasant, depends upon the standard (*massgebend*) presentation, i. e., upon the presentation which occupies the focus of attention; its intensity depends upon the 'affective values' of all coexistent presentations. Since it is correlated with the totality of given presentations, it cannot appear as 'mixed;' neither has it a variety of qualities, within pleasantness and unpleasantness; and though every presentation has 'affective value,' this is by no means to be confused with the doctrine of an attributive 'affective tone.' What is known as the 'coloring and shading' of feeling is a matter, not of feeling itself, but of concomitant presentation, of 'somatic sensation.' The James-Lange theory is right in its insistence that certain bodily changes are among the conditions of feeling; but it is wrong in identifying the sensations connected with these changes and the sensations connected with the 'expression' of feeling; the 'expression' results from the feeling; and the two groups of somatic sensation, concomitant and successive, must be sharply distinguished. Mood is an affective complex whose 'standard' presentation is somatic sensation. Emotion is an affective complex whose subjective side is always intensive pleasantness or unpleasantness, and whose 'concomitant' somatic sensations are also highly intensive; its 'standard' presentation is never somatic sensation. *Gemüt* is either a collective term for feelings and moods, or is the particular conscious (or psychophysical) condition of the *Gemütszustand* (feeling, mood, etc.)

The Universities of Ancient Greece. By J. W. H. WALDEN. New York, C. Scribner's Sons, 1909. pp. xiv., 367.

The period treated in this interesting little book is the first five centuries of the Christian era; so that Greece includes, besides the Balkan peninsula and the islands of the Aegean and eastern Mediterranean, Egypt and the adjoining parts of Libya, Asia Minor with Syria, Palestine and Arabia Petraea, Thrace, and Macedonia. In order to give historical perspective, a short account has been prefixed (under the headings Education at Athens in the fifth and fourth centuries B. C., The Macedonian period, Education and the State) of the Athenian education in pre-Alexandrian times, and of the conditions

which prevailed in Grecian lands in the last three centuries B. C. The body of the work sets forth the establishment, history and decline of university education, and the appointment, number, pay and social position of professors; discusses the subject-matter and methods of sophistic teaching; traces the career of a student, in boyhood, at the university, and during the years of struggle for a professional appointment; and informs us regarding public displays, schoolhouses, holidays, etc. The ideal of education in these centuries, as formulated by the emperor Julian, and endorsed by teachers like Libanius and Themistius, "received its embodiment in the man who had been trained, morally, intellectually, and aesthetically, to use his powers in the interest of the State. Such a man was the orator. The orator was not the man of fluent tongue and graceful speech solely; nor was he the man of scientific attainments or technical knowledge; he was the man of broad learning and general culture, trained to see the distinctions of right and wrong, and to act with reference to them in the service of his native city."

The book is written in an agreeable style; and though the intending reader may be disposed to cavil at the technical word 'universities,' he soon learns that the writer has reason for its employment, and that the exposition rests upon a solid basis of scholarship.

Die geistige Ermüdung: eine zusammenfassende Darstellung des Wesens der geistigen Ermüdung, der Methoden der Ermüdungsmessung und ihrer Ergebnisse, speciell für den Unterricht. Von M. OFFNER. Berlin, Reuther & Reichard, 1910. pp. vi., 88.

Mental Fatigue: a comprehensive exposition of the nature of mental fatigue, of the methods of its measurement and of their results, with special reference to the problems of instruction. By M. OFFNER. Translated by G. M. WHIPPLE. Baltimore, Warwick & York, 1911. pp. viii., 133. 'Educational Psychology Monographs.'

Das Gedächtniss: die Ergebnisse der experimentellen Psychologie und ihre Anwendung in Unterricht und Erziehung. Von M. OFFNER. Zweite, vermehrte Auflage. Berlin, Reuther & Reichard, 1911. pp. xi., 258.

"This translation," says Professor Whipple in his Preface, "has been undertaken because the monograph collates, systematizes, and appraises a mass of scattered and to most readers inaccessible material that bears upon a schoolroom question of unquestioned importance." The sentence sums up the character of Dr. Offner's work upon mental fatigue, and gives the reason for the warm welcome that it has received in Germany and for the undertaking of a translation into English. We may add that the author has made alterations and additions which practically constitute the American book a second edition, and that the translator has extended the bibliography of the original, and also added an appendix on the terminology of the German school system.

The first edition of the *Gedächtniss* was reviewed in this JOURNAL, xx., 457. The fact that a second edition is called for within two years of the date of publication speaks for itself. The author has simplified his exposition wherever possible, has defined more sharply and insistently his attitude to psychology, and has brought the book down to date both on the side of theoretical and on that of applied psychology.

Mental Fatigue: a comprehensive exposition of the nature of mental fatigue, of the methods of its measurement and of their results, with special reference to the problems of instruction. By M. OFFNER. Translated by G. M. WHIPPLE. Baltimore, Warwick & York. 1911. pp. viii., 133.

Psychology and Pedagogy of Writing: a résumé of the researches and experiments bearing on the history and pedagogy of writing. By M. E. THOMPSON. Baltimore, Warwick & York. 1911. pp. 128.

When Should a Child Begin School? An enquiry into the relation between the age of entry and school progress. By W. H. WINCH. Baltimore, Warwick & York, 1911. pp. 98.

Spelling Efficiency in Relation to Age, Grade and Sex, and the Question of Transfer: an experimental and critical study of the function of method in the teaching of spelling. By J. E. W. WALLIN. Baltimore, Warwick & York, 1911. pp. viii., 91.

These are the first four monographs issued in connection with the Journal of Educational Psychology. Professor Whipple's translation we mention elsewhere, in connection with its German original. Miss Thompson's essay on Writing is avowedly a compilation; but it is made by a competent and experienced teacher, and will no doubt do good service. The net outcome of Mr. Winch's investigation is that children should enter school at five years of age: to enter between three and five confers no advantage, at the time or later, in grade of work performed, in behavior, or in training of the attention; to enter after five may mean retardation. Dr. Wallin emphasizes the necessity of rational drill in spelling, and finds that the ability to spell words given in vocabulary form is, with very slight loss, available in written compositions. He advocates a liberal appeal to various types of imagery, but recognises that the psychology of this matter has not yet been adequately worked out.

A Beginner's History of Philosophy. By H. E. CUSHMAN. Vol. I., Ancient and Mediaeval. pp. xxi., 406. Vol. II., Modern Philosophy. pp. xix., 377. Boston, New York, Chicago; Houghton Mifflin Co. 1910, 1911.

Theories of Knowledge: Absolutism, Pragmatism, Realism. By L. J. WALKER, S. J. London; Longmans Green and Co. 1910. pp. xxxix., 696.

Abriss der Geschichte der Philosophie. Von C. J. DETER. Ninth edition, revised by M. FRISCHEISEN-KOEHLER. Berlin; W. Weber. 1910. pp. vi., 178.

These works fall beyond the sphere of interest of a Journal of Psychology, and we are therefore not able to give them the space that they deserve. Professor Cushman has produced a most readable student's introduction; the exposition is set upon a background of geography and literary and political history; the treatment in the main follows the lines laid down by Windelband. Those of us who were introduced to philosophy by way of Schwegler can only envy the present generation of students, who find a book like this at their disposal; the author plainly possesses marked pedagogical ability. Professor Walker gives us an elaborate criticism and analysis of the theories of knowledge named in his title; the claims of scrupulous impartiality, wide knowledge, and intelligent and judicious consideration of problems.

put forward on the author's behalf by Professor Maher, seem to be fully justified. Whether the main thesis of his work, that Realism affords the needed synthesis of Absolutism and Pragmatism for current philosophical thinking, is sound or not, is a question which must be left to specialists to decide. The little *Abriss* of Deter is probably familiar to all Americans who have taken a philosophical or theological degree at Berlin. The present edition has been rearranged and brought down to date by Dr. Frischeisen-Köhler, on the basis of Dilthey's *Grundriss der Geschichte der Philosophie*.

The Oriental Religions in Roman Paganism. By F. CUMONT. With an Introductory Essay by G. SHOWERMAN. Chicago, Open Court Publishing Co., 1911. pp. xxv., 298.

This book contains eight lectures, delivered by Professor Cumont in Paris and Oxford, which trace the transformation wrought in the religion of Rome, under the unifying influence of neo-Platonism, by the successive introduction of Oriental cults and mysteries. The lectures are entitled: Rome and the Orient, Why the Oriental Religions Spread, Asia Minor, Egypt, Syria, Persia, Astrology and Magic, The Transformation of Roman Paganism; the volume ends with some 75 pp. of notes, mostly bibliographical. We begin with a comparative picture of east and west; we are shown how the eastern religions, carried by merchants, soldiers, slaves, appealed to the senses, the intelligence and the conscience of the Roman; we are then told in detail how Cybele came from Asia Minor, Isis and Serapis from Egypt, Iasura and the many Baals from Syria, Mithraism from Persia; till we finally understand how, "by means of compromises between old Oriental ideas and Greco-Latin thought, an *ensemble* of beliefs slowly took form, the truth of which seemed to have been established by common consent." One result stands out clearly: that Christianity was not a sudden and miraculous change, but a composite of long and laborious growth: "the faith of the friends of Symmachus was much farther removed from the religious ideal of Augustus, though they would never have admitted it, than that of their opponents in the Senate." The book is a popular presentation of a great subject, by a scholar who is admirably equipped for the task.

Die Weltanschauungen der grossen Philosophen der Neuzeit. Von L. BUSSE. Fourth edition, by R. FALCKENBERG. Leipzig, B. G. Teubner, 1909. pp. viii., 156. 'Aus Natur und Geisteswelt,' Bd. 56.

Professor Falckenberg has wisely retained the plan and arrangement of this excellent little book. There is an introduction on the nature and problem of philosophy, and the problem of a history of philosophy. Then follow two main sections, covering modern philosophy to and after Kant; each is introduced by a general characterisation of the period. Then, under classificatory chapter-headings (Rationalism, Neo-Kantianism, etc.), come outline sketches of the systems of the great philosophers: first, a condensed biography; next, a list of the subject's principal works, and a couple of references to critics and commentators; last, the leading features of the system itself, with a sufficiency of back-and-forth reference to give a careful reader his perspective. The summaries are carefully and clearly written; witness the five pages that sum up the philosophy of Hegel!—It may be noted that the discussion is, for reasons of space, con-

finer to metaphysics, epistemology and ethics. Noteworthy, too, in the light of certain 'objective' methods of psychology, is Professor Busse's remark that philosophical systems cannot be measured by the yard: "a very important system, built on large lines, may be briefly summarised; a relatively unimportant system, because it is more complicated and less definitely organised, may demand a greater number of pages.

The Life and Letters of Martin Luther. By P. SMITH. Boston and New York, Houghton Mifflin Co. 1911. pp. xvi., 490. With illustrations. Price \$3.50 net.

"The present work aims to explain [Luther's] personality; to show him in the setting of his age; to indicate what part of his work is to be attributed to his inheritance and to the events of the time, but especially to reveal that part of the man which seems, at least, to be explicable by neither heredity nor environment, and to be more important than either, the character, or individuality. A new biography of Luther, however, requires . . . apology. . . . One reason [for the present work] is to be found in the extraordinarily rapid advance of recent research. . . . In another respect [the book] undertakes to present Luther to English readers from a standpoint different to that from which he is usually approached. I have endeavored to reveal him as a great character rather than as a great theologian. In order to do this I have given copious extracts from his table-talk and letters, those pregnant documents in which he unlocks his heart." So the author in his preface. He has produced an interesting and, so far as the layman can judge, a thorough piece of work.

BOOK NOTES

Aus dem Werdegang der Menschheit, von H. v. BUTTEL-REEPEN.
Jena, Gustav Fischer, 1911. 139 p.

This work, which has 108 illustrations, has grown out of a simple lecture in which the author attempted in untechnical terms to set forth the various stages of human development. Beginning with the Neanderthal skull, he proceeds to the discussion of Eoliths, Anthropopithecus, the Heidelberg man, the ice age, the stone and bone work of Diluvial man, the men of the French caves, development of primates, the art of primitive man, beginnings of agriculture, etc.

Criminal man according to the classification of Cesare Lombroso.
Briefly summarized by his daughter Gina Lombroso-Ferrero, with an introduction by Cesare Lombroso. New York, G. P. Putnam's Sons, 1911. 322 p.

This is a very convenient summary of the opinions of this distinguished man. The first part treats of the criminal world, the born criminal, his relations to moral insanity, insanity, epilepsy, insane criminals and criminaloids. Part two treats of crime, its origin, cause and cure, including prevention and repression; Part three, characters and types of criminals, their examination, the chief forms of crime, distinctions between criminals and lunatics and in an appendix is a brief summary of Lombroso's important works.

Geschichte der Psychologie, von OTTO KLEMM. Leipzig, B. G. Teubner, 1911. 388 p. (Wissenschaft und Hypothese VIII.)

This little book is divided into the following sections: the general direction or drifts of psychology, metaphysical and empirical. The second section discusses the development of the fundamental ideas of psychology tracing their development one by one and the third, the history of the most important psychological theories.

Heredity in relation to evolution and animal breeding, by WILLIAM E. CASTLE. New York, D. Appleton & Co., 1911. 184 p.

This little book is based on a course of eight lectures delivered in the fall of 1910 at the Lowell Institute and elsewhere. It treats of genetics in general, the duality of inheritance, germ plasm, Mendel's law, the determination of dominance, the evolution of new races by loss or gain of characters, also by variation of their potency. It discusses whether Mendelian unit characters can be modified by selection, the effects of inbreeding, heredity and sex.

The grades of life. Edited by M. Sopote. Oxford, 1909. 37 p.

This pamphlet is based upon the idea of Pascal that since we often dream that we dream, heaping up one dream upon another, it is therefore quite possible that this life itself is but a dream on which the other dreams are grafted and from which we wake at death. Upon this striking passage the author, M. Sopote, B. Sc. Oxon, bases his conjectures which are set forth in the form of 37 letters.

The Goulstonian Lectures on the sensibility of the alimentary canal, by ARTHUR F. HERTZ. London, Henry Frowde, 1911. 83 p.

The author believes that no branch of medicine has made greater progress in the last fifty years than that which deals with the diseases of the alimentary canal. The great step in advance was made by Brinton in 1858. Then, fifteen years later, came Kussmul, who introduced lavage into gastric therapeutics, and Leube, who extended the use of the stomach tube to diagnosis as well as treatment. These methods are comparable in opportunity to that of examining the urine in diseases of the kidneys. Later Adolf Schmidt has shown what valuable data the examination of the faeces can yield to disturbance of intestinal digestion. As our knowledge of chemical functions was revolutionized a couple of decades ago by the introduction of test meals, so now the X-ray and stomach pump have added very greatly to knowledge and resources. It is impossible to understand the origin of pathological sensations while the law of healthy organs to various stimuli is unknown and much that has been written upon visceral sensibility is purely theoretical. The author discusses in the several chapters of his book tactile, thermal and chemical sensibility, the sensations of fullness and distension, of emptiness and hunger, pain and variations in the sensibility of the canal.

Man, king of mind, body and circumstance. By JAMES ALLEN, New York, Thomas Y. Crowell & Co., 1911, 55 p.

This book treats of the inner world of thoughts, the outer world of things, habits, its slavery and its freedom, bodily conditions, spiritual domination, conquest not resignation.

Asthetik, von RICHARD HAMANN. Leipzig, B. G. Teubner, 1911. 120 p. (Aus Natur und Geisteswelt.)

This little work discusses the essence of aesthetical experience, its modifications, its elements, the extra aesthetic content, categories and finally, the essence of style.

Elements of physiological psychology, by GEORGE TRUMBULL LADD and ROBERT SESSIONS WOODWORTH. New York, Charles Scribner's Sons, 1911. 704 p.

It is now nearly a quarter of a century since the appearance of the first edition of this treatise (1887). It was, when it was published, the only work of its kind in English or in any other language, save the great work of Professor Wundt then in its second edition. Although there has been a very great development since, the author believes that "it is entirely safe to say that neither the extravagant hopes nor the extravagant fears of 25 years ago with reference to the results of the so-called new psychology have been verified. The fundamental problems with regard to the nature of man's mind and its relations to the organism, its place in the scale of development and destiny remain essentially unchanged." The chief point of evaluation of such a new edition is to know whether it is revised to date. The author says that "there are several important changes" the chief being that this edition is more physiological. Two entire chapters, one on the place of the nervous mechanism and the other on the development of the nervous system have been added to Part I and "all the other chapters of this part have been carefully

rewritten and in most cases considerably expanded." A new chapter on the localization of cerebral functions has been transferred to it. The other chief change is the great reduction in the third part because the author has expressed his views elsewhere, especially in his *Philosophy of Mind* (1895) and his *Theory of Reality* (1899).

Body and mind, by WILLIAM McDUGALL. London, Methuen & Company, 1911. 384 p.

The author in writing this book has aimed "to provide for students of psychology and philosophy within a moderate compass a critical survey of modern opinion and discussion upon the psychophysical problem, the problem of the relation between the body and mind." Most of the book "is occupied with a survey of modern discussion and modern theories of psychophysical relation." The author pleads for what he calls animism as distinct from the Jamesian transmission or percolation view of things and seeks to give due justice to the evolutionary point of view. The author is satisfied with neither parallelism nor interaction. He holds that not only conscious thinking but morphogenesis, heredity and evolution are psychophysical processes all conditioned and governed by psychic dispositions built up in the course of the experience of the race. So long as this process proceeds smoothly in routine fashion probably the species may go on unconsciously or subconsciously, but nevertheless the circumstances of the organ demand new and more specialized adjustment. Their smooth automatic working is disturbed and the corresponding meanings are brought to consciousness and by conscious perception, thinking and striving the acquired adjustment is effected.

Psychology and pedagogy of writing, by MARY E. THOMPSON. Baltimore, Warwick and York, 1911. 128 p.

This work gives a story of the historical development of the alphabet, résumés of the experiments bearing on the psychology of writing, its pedagogy and a bibliography.

A brief course in the teaching process, by GEORGE DRAYTON STRAYER. New York, The Macmillan Company, 1911. 315 p.

This book is the outcome of experience in trying to help teachers grow in skill in the art of teaching and the power to appreciate the work in which they are engaged. It deals with problems that the teacher faces every day and avoids technology. Its chapters are the aim of education, factors conditioning the teaching process and the process itself, the drill, the inductive and the deductive method, the lesson for appreciation, for study, review, for examination, the recitation lesson, question and social phases of the recitation, physical welfare of children, moral training and class management, lesson plan, teacher's relation to supervision, course of study and measuring results. In a rather elaborate appendix, F. T. Baker schedules the teaching of English, geography and other topics in the elementary schools.

Animal intelligence, by EDWARD L. THORNDIKE. New York, The Macmillan Co., 1911. 297 p.

The author's main purpose is to make accessible to students and others his own experimental studies of animal instinct and behavior.

They have a twofold interest; first, representing the first deliberate and extended application of the experimental method and second, as an introduction to the literature. They mark a change from books of general argumentation to monographs reporting technical experiments. The reports are mainly reprints from the author's work with which all experts are already more or less familiar. The excellent work Professor Thorndike did really marks an epoch and it is a great advantage to have it made accessible in this excellent form. After describing his apparatus, he reports his experiments on cats, dogs, chicks, with his inferences on associations, concepts, habits, attention, etc., and criticisms of previous theories. His note on the psychology of fishes and his study of the mental life of monkeys, his laws on the hypothesis of behavior and the evolution of human intellect are all of great importance, but too well known to need explanation here.

The teacher's practical philosophy, by GEORGE TRUMBULL LADD. Funk & Wagnalls Company, New York, 1911. 331 p.

This book emphasizes the personal and moral element in teaching. The teacher's personality has most to do with the formation of character. This magnifies the office of the teacher. The book is based on the author's lectures given in the Far East. His fifteen chapters are grouped under four heads; the function, equipment, chief ideals of the teacher and his relation to society and the state.

The psychology of conduct, applied to the problem of moral education in the public schools, by H. H. SCHROEDER. Chicago, Row, Peterson & Company, 1911. 287 p.

This book was not written for specialists but for teachers. It seeks to trace conduct to its sources and to show how the principles of it may be applied to the actual work of teaching. The successive chapters set forth the aim of education, the source of conduct, regard for self and others involving estimation and attachment, benevolence, good will, regard for rights, duty, knowledge, truth, aesthetics and religion. The work is essentially philosophical rather than psychological. It deals with principles and to the casual reader it would seem that it lacks definiteness or application. Judging from his references, the author's reading has been more along general and abstract lines than detailed and specific.

La joie passive, par M. MIGNARD. Paris, Alcan, 1909. 276 p.

This is a study of pathological psychology. The author first discusses euphoria and ecstasy with and without toxins, the satisfied idiots and dementes, the condition of satisfaction in general, paralysis in senile dementia, the motor, sensory, organic or vegetative state, the theory of movements and finally, certain practical questions.

Scientific mental healing, by H. ADDINGTON BRUCE. Boston, Little, Brown, and Company, 1911. 258 p.

These essays which had mostly been published elsewhere are here revised and the volume is designed to give the reader a brief yet comprehensive account of the principles underlying psychotherapy, although several chapters that very indirectly relate to this are included.

The author deals with the evolution of mental healing, its principles, methods, with matters of the mind, hypnotism as a therapeutic agent, secondary cells, psychology in every day life, with the history of half a century of psychological research. In such a book one naturally nowadays first looks to see whether the writer has an adequate knowledge of the new Freudian School which to our mind has already written its mene, mene, tekell, upharsin on the wall for the old kind of mental healing which this author has very largely in mind. It is evident that the author has not considered Freud worthy of serious study and he makes some strange statements, e. g., that "scarcely another leading psychopathologist has accepted this sweeping audacious theory" referring to Freud's infantile sex theory. The other allusions to Freud are so very slight and as we might say eccentric, and he is so far from seeing the central idea of Freud that to our mind, his book by this ignorance must be called inadequate to the subject and behind the times, chatty and interesting as it is.

A watcher of the skies, by GUSTAVE F. MERTINS. New York, T. Y. Crowell & Co., 1911. pp. 376.

This is a psychological novel. A young man is at the outset reduced from riches to absolute poverty, loses his wife, a lady whom he had been compelled to marry formally because they had been shipwrecked together for a few days on a desert island. All memory of his past is wiped out by a serious automobile accident so that he begins life again. We are not told much of the stages of the re-education of his second ego, but he appears five or six years later as a young and rather successful physician who had also inherited an immense estate with valuable mines in Mexico and whose secret was known and utilized for his own benefit by a remarkable physician who drew all the revenues from his estate and kept him in his secondary state and was able by imperious domination to hypnotize him at will and make him do his bidding. He also fell in love with the doctor's niece, who knew of his condition. The main interest of the story centers in his depression at realizing that he had lost his real self and in the struggles to get it back. His wife, who had left him, at first, realizes her love for him and appears on the scene, calls him by name, tries in every way to make him remember her but in vain. He was incidentally a marvelous violinist in his primary condition and was able to play marvelously well in his secondary state despite the fear of his master that it would bring him back and therefore deprive him of his income. The doctor, the watcher of the skies, has a marvelous laboratory in the country, where he performs all kinds of mystic experiences with N- and many other rays, surrounding himself with mystery and his estate with spies lest his iniquities should be laid bare by a man who knows them and has come to rescue the hero of the story from his secondary slumbers, from which finally in the denouement he awakes and is reunited to his wife. The plot is a bold one but betrays hardly more knowledge of the psychic phenomena it describes than it does of modern physical science with which it also dabbles much. Thus while we do not attempt to pronounce upon the literary merits of the book, the verdict of those who know what such studies can do must be shrinkingly unfavorable because of the many utterly impossible, not to say preposterous, situations it describes.

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DESCRIPTION vs. STATEMENT OF MEANING

By E. B. TITCHENER

By the 'description' of an object we mean an account so full and so definite that one to whom the object itself is unfamiliar can nevertheless, given skill and materials, reconstruct it from the verbal formula. Every discriminable part or feature of the object is unambiguously named; there is a one-to-one correlation of symbols and the empirical items symbolised; and the logical order of the specifications is the order of easiest reconstruction. This, then, is what we mean by 'description' in psychology; and the meaning is brought out, clearly enough, by the adjectives—'analytical and abstractive'—which are applied to psychological description in current discussion. Psychological description is analytical, in that the given consciousness or part-consciousness is analysed into its elementary constituents, into sensations, images, attitudes, etc.; it is also abstractive, in that the inseparable attributes of these elements or of their groups (quality, intensity, form of combination, etc.) are specified in the report.¹ The objects described may be very different: we may be interested in the variation of some quantitative attribute of a single sensation, or in the temporal course and

¹ Sometimes the 'abstractive' means that psychological analysis is itself abstractive, that the psychological elements or complexes are not real separables; but if this is the point to be made, the current phrase is 'abstractively analytical' rather than 'analytical and abstractive.' At all events, the point does not concern us here.

confluence of a group of processes, or in the cross-section of a total consciousness: in every case, description consists in the unambiguous coupling of every phase or item of our conscious experience with a word, in such wise that a reader of normal mental constitution can reproduce the experience for himself.

It may be doubted whether we have attained to complete description in any department of psychology; it may, indeed, be doubted whether complete description, implying as it does the adequate rendering of the continuous by the discrete, is not in the last resort a contradiction in terms. Fortunately, however, completeness of description is not necessary to scientific advance. When we have carried our analysis and abstraction as far as present methods allow, we can sum up the results in collective terms, and thereafter employ these terms for descriptive purposes; we can speak, in the given case, of 'feeling of familiarity' or of 'verbal idea,' referring to previous analyses for detailed description. It is not even necessary that these previous analyses agree: two observers may report a 'conscious attitude,' or a 'form of combination,' or a 'feeling of relation,' although they differ widely in their view of the nature and composition of what they observe; and the reports may be of value to a descriptive psychology. This procedure may be continued, until we reach the "conceptual shorthand" of which Pearson speaks:² we are still describing, because we are going on the assumption, expressed or understood, that the road to the ultimate terms of description is always open, that we can work back from our concepts to our point of departure,—practically, to the attitudes and forms and feelings from which we agreed to start, theoretically to the elementary processes and irreducible attributes whose verbal correlates furnish the most nearly 'complete' description of which the science is capable.

Psychological description, however, is never easy; the verbal formulas of the most highly trained observers are likely to be imperfect; every new investigation leads to a new result. Moreover, psychological description is often warped by prepossession; we have a host of terms—secondary criteria, stimulus error, logical reflection, laboratory atmosphere, faculty tradition, pleasure-pain dogma, associationism, sensationalism, intellectualism, and many more—that are used by critics to stigmatize the bias of the observer. Certain forms of prepossession take shape within psychology; certain others

²K. Pearson, *The Grammar of Science*, 1900, 504; cf. E. Mach, *Popular Scientific Lectures*, 1895, 193, etc.

are prior to any psychological observation; the observer is not simply a psychologist, but moves, so to say, in various worlds, of which the psychological is at best only one, and may be one of the less familiar; it is natural, then, that, confronted with a difficult task, he should be tempted to adopt an attitude more habitual than that of psychology, and to offer as psychological description a report which in fact is not psychological at all. The temptation to this shift of attitude is, indeed, exceedingly strong; for the situation in which the psychological observer is placed bears a close resemblance to situations which arise outside of psychology, and which must be met by all of us every day of our lives.

It is difficult, at this point, to keep the discussion at the empirical level; but I shall try, at any rate, to steer clear of epistemological complications. The observer moves, I said, in various worlds. Now it is clear that the world which is most familiar, and to which our response is most direct and certain, is the world in which we were brought up as children; the world of things and people, of boats and trains, of relatives and strangers, of quarrels and reconciliations, of successes and failures. No doubt, this world is modified as we grow older; our attitude to it changes with increase of our scientific knowledge. But it is never identical either with the world of physics or with the world of psychology: for physics deals, not with boats and trains, but with masses and distances and velocities; and psychology deals, not with quarrels and successes, but with emotions and voluntary actions. And the difference between the world of practical life and the world of science is reflected in their languages: for in scientific description, words are labels of facts; in daily intercourse, they are signs of import.

I may, perhaps, be permitted to fall back upon an illustration. A half-trained observer, attempting his first bit of serious introspection, will probably report that at first he was 'puzzled,' that he sat for some time in a blank 'perplexity.' He is told forthwith that a report of 'puzzle' or 'perplexity' will not do; the terms are not introspective terms. 'Why?' he asks; 'are they not the name of an emotion?' And then comes the teacher's task of explanation. The word 'puzzle' or 'perplexity,' he points out, gives him the key to the observer's predicament, acquaints him with the import of the situation, enables him to handle it, shows the need of just the kind of comment that he is now beginning; but the word tells him nothing whatsoever of the observer's individual experience, of the particular 'feels' that constituted the per-

plexity in the particular case. It is a word that he perfectly well understands; and this apprehension of its import is not only sufficient, but is also the one thing necessary, for the affairs of everyday life, for social intercourse, for the regulation of behavior. Scientific description, on the other hand, is always an instrument of reconstruction; and as psychological observation is individual observation, the description must also be individual; the reader of the observer's report must be able to reconstitute, to reconstruct, the perplexity which is therein described, precisely as it was lived. The word 'puzzle' is not, then, a descriptive label; it does not attach, without ambiguity, to certain conscious processes in a certain arrangement; if the reader seeks to interpret it descriptively, he finds himself free to invent or imagine processes and arrangement in terms of his own mental constitution; whereas a description would tie him down, item by item and phase by phase, to a specific perplexity whose course and composition might differ, in various ways and to various extents, from what was usual with himself. The distinction is, I hope, plain; it is not worth while to pursue the illustration further. But it may be worth while to formulate again the conclusions to which the illustration leads. These are, first, that the word 'puzzle,' as used by the half-trained observer, is not a psychological term at all; it is a sign of the import of a practical situation; and, secondly, that the very same word 'puzzle' may be used, by a trained observer, as a shorthand expression for observed psychological occurrence; it is then a descriptive term, a label of fact. The ultimate test, in cases of doubt, is the user's ability to expand the term to a descriptive formula, or at least to trace it back in descriptive fashion to the conventional starting-point of the discussion. If the observer has previously analysed perplexity into localised organic and kinaesthetic processes, affective concomitants, verbal ideas, and so forth, then the term may (under the conditions of a particular experiment) be accepted as descriptive; if it has been agreed between experimenter and observer that the 'conscious attitudes' are to be taken for granted, then the report 'attitude of perplexity' may, again, be accepted as descriptive. But the word as employed by our half-trained observer is descriptive neither in fact nor in intention: not in fact,—for there is no guide to descriptive reconstruction; but not, either, in intention,—for the observer shows, by its employment, that he has missed the point of the exercise; he is trying to express the import of the situation rather than its experienced *quale*; he

has not realised the difference between psychologising and behaving.

The attempt to be empirical makes one longwinded; and I have no doubt that exception may be taken to many of my phrases. I am satisfied if the reader has clearly in mind the distinction that I am drawing; and I have tried to exhibit the distinction in a way that is independent of school or system. I turn now to the special subject of this paper: the appearance of description and of what I shall call 'information' in the recent experimental psychology of thought. I know of no English word that may, in this connection, be opposed, naturally and as a matter of course, to the word 'description'; but we may say provisionally that a term like 'perplexity,' when it is not descriptive, conveys information, is *informatory*.^{2a}

I begin—readers of the JOURNAL will not require a preface—with the relevant passages in Dürr's critique of Bühler. In rough translation, they run somewhat as follows:

"I have followed the course of Bühler's investigation, in which I was privileged to take part as observer, with keen interest. And I have been led to a rather curious result, which has altogether changed my ideas of the best method for the conduct of thought-experiments. Again and again, as I was observing for Bühler, I had the impression, though I was not able at the time to formulate it very clearly, that my report was simply a somewhat modified *verbal statement* of the thoughts aroused in me by the experimenter, and that this verbal statement could not properly be regarded as a psychological description of the thoughts. What I mean by this antithesis of 'verbal statement' and 'psychological description' will perhaps become clearer if I suggest that the layman in psychology would be giving introspective reports every time that he exchanged thoughts with a friend, unless there were some difference between verbal expression and psychological description. The introspecting psychologist will not, of course, be satisfied with a bare mention of the content of his thought during the experiment; he will specify the sensations and ideas that may have appeared in the course of his thinking; and he will refer to the content of his thought in such a way as to make it clear that the experience was a thought-experience. He will say: The thought came to me that . . . , or I had the consciousness that . . . , or It occurred to me that . . . , etc. But it is evident that to designate something a thought is not by any means to describe the nature of this thought. No doubt, we increase our stock of psychological knowledge when we learn that mental processes which are neither verbal ideas nor imaginal complexes of any other sort, nor yet feelings, may enter consciousness in relative isolation and independence, and that these processes are fittingly designated thoughts. But we do not owe this

^{2a} I take advantage of my proof-sheets to remark that the above paragraphs have answered, by anticipation, the special question asked by R. P. Angier. *Journ. of Philos.*, etc., ix, 1912, 137. The general subject of introspection must stand over for a later article.

discovery to Bühler's investigation. Bühler's aim is not merely to verify a familiar fact; he means psychologically to describe the thoughts of whose occurrence he was assured before the work began. . . .

"The report shows that real thinking does not move with the wearisome parade march of formal logic. Logical schematism ravel out the close-packed tissue of thoughts. The practised thinker does not laboriously abstract the particular from the universal, but in a single act apprehends the universal and the particular in the universal. These are interesting facts, that may be turned to especially good account for a less dead-and-alive presentation of logic in our text-books. But they contribute nothing to a psychological description, to an analytical or abstractive definition of the experience in which the apprehension of the relations between particular and universal is given. . . .

"The problem of the psychologist is to show the characteristics of all these acts of thought, not by reference to what is apprehended in them, but by demonstration of their proper nature. This question Bühler leaves unanswered."¹

Dürr's 'verbal statement' is, then, an intimation of the content or object of thought; it corresponds to what I have spoken of above as 'information.' As 'somewhat modified' by psychological environment, it contains a reference of the observer's experience to a general psychological heading, to the category of Thoughts. If our half-trained observer had reported, not simply that he was puzzled, but that he 'felt' puzzled, or had a 'feeling' of perplexity,—and if he used the word 'feeling' in some psychological sense,—then he would have done, at his lower level, precisely what Dürr does in Bühler's investigation. The 'perplexity' is informatory, refers to content or import; the 'feeling,' used as a psychological rubric, is, so far as it goes, descriptive. Dürr's intimation of content, he gives us to understand, is psychologically irrelevant; the phrases that came before the intimation (I had the consciousness that . . . , etc.) are psychological, but they bring us only to the threshold of a true psychological description.

I pass on to von Aster. An experience, von Aster says, may be characterised in two different ways.

"This twofold characterisation is explained as follows. On the one hand we are able, in the strict sense of this term, to *describe* the experience, just as we describe objects at large: by comparison, by grouping it with similar experiences, by emphasising particular features. But secondly, the experience may be *communicated* by some special word [or phrase]. Which of these characterisations, now, is the better, the more accurate? Which of them brings the experience nearer to us, gives us the more intimate familiarity with it? [It must be remembered that] every *description* of an experience has, of necessity, some-

¹ E. Dürr, Ueber die experimentelle Untersuchung der Denkvorgänge. *Zeits. f. Psychol.*, XLIX, 1908, 315 f., 322, 323. Italics mine.

thing rough, awkward, incomplete, about it; that is why we are glad to exchange it for communication. Over against a conscious attitude or an affective state, description and communication stand to each other in the same relation as description and delineation over against a physical thing. Description names and defines the parts; but the parts, when put together, never yield the whole; while the drawing, and the communicating phrase, give the whole in unitary form. Communication is superior to description, just precisely as the depiction of mental states by the poet is superior to that offered by the psychologist."⁶

To quote a passage of this sort is not quite fair to the writer, who works out his position gradually, by means of examples. Since, however, I want him to speak for himself, I venture to translate a few significant sentences,—with the confession that they are torn from particular contexts, and with the recommendation that the article be read as a whole.

(1) "It is not necessary that the observer have any conscious realisation of the difference between description and communication. The problem is, to pin down a certain series of experiences; and communication, if it is characteristic, satisfies the conditions even better than description. That is to say, expression of the communicative kind suits the disposition aroused in the observer by the instructions given, and is therefore accompanied by a very positive 'consciousness' that the task set 'has been satisfactorily performed.'"⁷

(2) "Description has always an approximative character, which comes out with especial clearness when the experiences are as difficult to arrest [as they are in the thought-experiments]; communication has, oftentimes, the character of high assurance, of a certain self-evidence."⁸ Even when the report directly 'names' the contents of consciousness, and is therefore properly to be called descriptive, "the verbal expression may carry a direct conscious reference to the imaginal complex, and yet there may be a clear 'consciousness' of the insufficiency of the image; the words mean more than is given in this image."⁹ But communication, too, has its difficulties. "Sometimes the reproduction is assured and definite; phrases crop up with the consciousness, That is precisely what the experience 'meant.' At other times the assurance and self-evidence are lacking; I say that the experience contained 'thoughts' which I may 'perhaps' express as follows, or which 'seemed' to take this or that direction. And finally it may happen that I begin with a rough paraphrase of what was 'meant,' and that then the 'right' or 'fitting' expression suddenly suggests itself."¹⁰

⁶ E. von Aster, *Die psychologische Beobachtung und experimentelle Untersuchung von Denkvorgängen. Zeits. f. Psychol.*, XLIX, 1908, 69. The reader may be reminded that Dürr's critique was read at the Frankfurt Congress in April, 1908; that von Aster's paper, already at that time completed, was published in September of the same year; and that Dürr's article followed in October.

⁷ *Ibid.*, 70; cf. 72.

⁸ *Ibid.*, 71; the writer is contrasting the attitudes of the observers in Marbe's and Bühler's experiments.

⁹ *Ibid.*, 72 f.

¹⁰ *Ibid.*, 93.

(3) It is sufficiently plain that communication is not description; but the writer adds an emphatic statement of their incongruity. "Since communication, with whatever assurance it may be made, is not of itself a *description* or a direct identification, the question now arises, *What* experiences, then, gave rise to this communication?" And as we cannot infer experience from communication, so we cannot either infer 'meaning' from description. "The mere consideration of the facts of consciousness, the experiences, which accompany the 'intelligent' utterance of a sentence, need tell us nothing at all—at all events, need not inform us completely—of the content of our 'meaning.'" ¹⁰

(4) As to the nature of communication itself, there can be no doubt that it is an expression of import. The words "Oh, yes,—that is one of those paradoxes of Nietzsche's" communicate a repugnance, an impatience, an indifference; that is, they give the import of a situation which they fail altogether to describe.¹¹ The whole essay might be quoted in support of this conclusion. Here, for instance, is a relevant passage: "What do these observations [of Messer and Bühler] show? On their face, they show nothing more, again, than that experiences were present which the observer communicates by certain verbal expressions, and—to particularise—by expressions regarding the object designated by the [stimulus] word:" it is the import of the stimulus word that is communicated.¹² But we have the writer's direct testimony: "What Dürr here calls 'verbal statement,'" he says, "I call 'communication.' And Dürr's assertion that Bühler's observers took up, not a descriptive, but a communicative attitude, is the more noteworthy, as Dürr was himself one of these observers."¹³

Bühler, in his rejoinder to these criticisms, refuses to identify 'verbal statement' and 'communication.' "Von Aster thinks that his 'communication' is the same thing as what Dürr means; but that can hardly be correct."¹⁴ There is, undoubtedly, this difference: the phrase 'verbal statement' has an intellectualistic ring; the word which I have translated 'communication' carries rather, in the German, an affective reference,—implies a sort of self-revelation or self-betrayal, such as is given by the 'expression' of emotion. I do not think, however, that the difference can be stressed. And I do not think that, on any view, it is essential: it seems to derive simply from a difference of psychological system. In the sphere of Bühler's thoughts, Dürr operates with a 'relational consciousness,' von Aster with affectively toned atti-

¹⁰ *Ibid.*, 102; cf. 77.

¹¹ *Ibid.*, 82.

¹² *Ibid.*, 65 ff.

¹³ *Ibid.*, 85; similar expressions occur, *e. g.*, 86, 90.

¹⁴ *Ibid.*, 107. The words for 'communicate,' 'communication' are *kundgeben*, *Kundgabe*. I hope, however, that no reader will be satisfied to accept my translations; the terminology of this chapter of psychology is still so unsettled that, in the last resort, recourse must always be had to the original German.

¹⁵ K. Bühler, *Zur Kritik der Denkexperimente*. *Zeits. f. Psychol.*, LI., 1909, 117 f., and ref. to Ber. d. III. Kongr. f. Psychol.

tudes and with direct impressions of sameness, relation, etc. Dürr, then, naturally speaks of a 'somewhat modified (i.e., grossly psychological) verbal statement,' and von Aster speaks as naturally of '(expressive) communication.' The 'verbal statement' and the 'communication' as such are, I believe, what I have called 'information;' the 'somewhat modified' and the implied 'expressive' give a psychological turn to the information, the former accenting thought, the latter rather accenting feeling. Here, of course, I am interpreting; but the interpretation is nothing more than a generalised reading of the facts; and if doubt remains it must be doubt, not of the rightness of the interpretation, but of its ability to mediate between von Aster and Bühler. 'I am saying, in my own way,' von Aster declares, 'just what Dürr said;' and Bühler replies: 'No, you are saying something else.' I have shown, now, that there is a difference; but I ascribe it solely to the personal standpoint and preoccupation of the critic; it is not, so far as I can see, a difference of criticism.

Meanwhile, it is notorious that the criticism has failed to convince those against whom it was directed; we are still told that there appear in consciousness, from the point of view which reveals perceptions and feelings and ideas, processes that can be named, labelled, described, only as 'Bewusstsein von,' 'Wissen um,' and so forth; we are asked to include thought-elements, relation-elements, awarenesses, in our analytical vocabulary. This state of affairs suggested the modification of method which was described by Jacobson in the last volume of the JOURNAL. The observers in certain experiments were asked to separate 'description of process' from 'statements concerning meaning.' The word 'process' is here used in the sense of the German *Erlebnis*; it was thoroughly familiar to the observers; whereas "no definition of 'meaning' was furnished by the experimenter." The instruction ran: "Put direct description of conscious processes outside of parentheses, and statements concerning meanings, objects, stimuli and physiological occurrences inside." I wish to emphasise the fact that the observers were hereby required to put *all* conscious processes (including thoughts and awarenesses, if these occurred as processes) in the one report, and to put in the other—not 'meanings' outright, but—*statements concerning meanings*. To have separated, at the outset, 'process' and 'meaning' would have been to beg the question at issue; for 'meaning,' whether passive as 'signification' or active as 'intention,' might appear in

direct experience as a specific form of process. On the other hand, a 'statement concerning meaning' is clearly an informative, not a descriptive statement; its banishment from the introspective record is therefore justified; and its removal should indeed, beside freeing the introspective report from irrelevancies, call attention to *lacunae* in that report itself.

I do not propose to discuss in detail the results of Jacobson's paper. The general outcome is that there are no 'significations' or 'intentions' to be found among the processes; that "the correlated meanings and processes are two renderings, from different points of view, of one and the same experience;" that 'meanings,' in other words, must always be 'stated,' and cannot be 'described;' and that a report from which the 'statements of meanings' have been removed is not on that account descriptively inadequate. In connection with this general result, however, there were three points in particular which seemed to me to need working out. They are as follows:

(1) "F at first showed occasional uncertainty as to what constituted meaning; and D for some time showed occasional doubt and inconsistency. Eventually, however, the reports of all four observers became practically uniform." How are we to explain this uncertainty, doubt, inconsistency?

(2) "Just as processes flit by on the passing instant, so do meanings change and elude the observer; and the skill in expression of meaning acquired in daily life is comparatively rough and superficial." How, exactly, do meanings 'change?' Do they slip into one another, in the manner of dissolving views; do they shift abruptly; do they behave in both these ways? Is there any marked difference between change of process and change of meaning?

(3) "We find that wherever there is meaning there are also processes; and we find that the correlated meanings and processes are two renderings, from different points of view, of one and the same experience." What are these 'points of view?' Jacobson expressly decides to leave this question open. I do not know whether, on the basis of his material, it could have been answered; and if that is the case, I do not know what his own answer would be. What I have to say upon the question is, therefore, said upon my own sole responsibility, and does not commit Jacobson in any manner. I thought it worth while to attempt an empirical characterisation of the two attitudes, or points of view, taken by the observers; and Miss Day and Mr. Foster—the D and F of Jacobson's paper—very kindly put themselves at my disposal

for these observations and for those demanded by (1) and (2) above. Three sorts of experiments were made, with words and sentences as stimuli: in some, the observer gave first a full statement of meaning, followed by a report (as complete as could be managed) of process; in others, this order was reversed; in yet others, the two reports were intermingled, so that description of process and statement of meaning alternated, as they had done in Jacobson's experiments. It was understood that these new experiments were to be performed with the same seriousness and conscientiousness as the old; the observers knew, however, that they would be required, upon the basis of the whole work, to characterise the attitudes aroused by the different instructions. The task was difficult,—how difficult, I did not myself know until I had attempted it; and although we all three realise that the results are imperfect, I must add that they taxed to the utmost the training and goodwill of the observers.

(1) The following are excerpts from the observers' answers to the question as to the reason for their uncertainty and doubt at the beginning of Jacobson's experiments.

Observer D.—There was, as I remember, a general hesitancy at entering upon a new field; I had never before been asked to make the twofold report, and I could not approach the task coolly and with assurance. . . . More important, though, was my uncertainty as to what the instruction really was; no definition of 'meaning' was given. I was inclined to suspect *E* of a bias toward logic, and I had been taught to regard logical reflection as the worst enemy of introspection. On the other hand I knew that in some instances his psychological terminology had differed from that to which I was accustomed. At first, therefore, I was not a little troubled by doubt as to what he meant me to do when he said "State the meaning" of the word or sentence. . . . I suspect that I am naturally rather a 'subjective' observer, and dependent upon instructions; it sometimes requires a decided effort for me to accept a situation passively, without personal reference to *E* and to what he wants me to observe. My uncertainty led me to take up now one attitude and now another. At times, acquiescing as I thought in *E*'s view, I sought for the verbal, dictionary definition (words were then the stimuli); at other times I stubbornly followed my own natural bent, and waited passively for the stimulus to appear meaningful. . . . After a while, I found that the meanings came of themselves, and I gave them as they arose; as *E* made no comment, I assumed that I was thus following instructions, and the experiments became less trying and fatiguing. . . .

Observer F.—At first I had difficulty in placing the parentheses in the report according to rule, because, even with the best phrasing of which I was then capable, the report did not fall clearly into two such divisions. Obscurity, unitariness, swiftness of passage of complexes; the large amount of material to be reported upon before it slipped from memory; lack of command of language, both for direct description and for statement of meanings: these and other practical conditions led me often to use what I should call indirect or indicative description.

So I reported an auditory image 'more as if whispered than as if said in ordinary voice,' kinaesthetic images or sensations 'such as I get when standing and bending the right leg,' etc.; and I found it hard to decide, at first, whether these clauses should go inside or outside of parentheses. Later the difference between statement of meaning and indirect description became clearer; but in some early reports there was a mixture of standpoints; 'vague,' applied to an image, for example, meant vague descriptively and also vague logically. . . . Secondly, and more importantly, I was not always sure as to the *extent* of the meaning, whether of the meaning actually present or of the meaning called for by the instructions. I did not know what purpose was implied in the instruction to state meanings. One may, I think,—though I realised this less clearly at the time,—state the meaning of a situation variously according to the purpose which is involved, the basis which is presupposed. There is a narrow meaning with reference to the individual experiment and to myself as observer; there is a wider meaning with reference to the day's work, and the working relations between the experimenter and myself; and there are many other meanings, with reference to yet other aspects of life. I felt that these meanings were different, and I did not know whether some of them were irrelevant or whether I was to think out, to search for, all possible meanings. It is not so much, I believe, that "the skill in expression of meaning acquired in daily life is comparatively rough and superficial" (though this statement is, no doubt, true in a certain measure), as rather that the situations of daily life define their own universe of meaning, supply of themselves a basis for meaning; whereas the instructions in our experiments left this universe undefined. . . . I finally settled down to the narrow, directly experimental, meaning, but I had all through a sort of mental reservation, to the effect that other and wider meanings might be made out.

The replies need no interpretative comment. It is interesting, however, to note the difference of type,—a difference which led D to remark, at the conclusion of the experiments, that statement of meaning is easier than report of process, and F to make an emphatic declaration to the contrary. The task of description, always difficult, is especially difficult for an observer who leans toward the subjective type; and D, when she has once satisfied herself that she clearly understands the demand for meanings, falls back upon their statement with some relief. F, an observer of a somewhat extremely objective type, relies on his training for the report of processes; if he cannot describe everything, he will describe what he can. But the request for meanings puzzles him: *what* meaning shall he state? the perception of a letter? the perception of a letter as stimulus in a thought-experiment?—where shall he draw the line of meaning? So D reports, characteristically, that the meanings 'came of themselves,' while F insists that meanings are always matter of reflection, have to be sought for, to be decided upon. And D is able to use a foregone statement of meaning to help out

her later description of process, while F finds that the prior formulation of meaning tends to drive process out of mind.

(2) I quote again from the replies of the two observers.

Observer D.—The meanings in these experiments are perfectly definite and discrete things, distinct from one another. There is no stage of transformation of one meaning into another, but rather a 1-2-3 sequence with a clean-cut division between the individual meanings. There may be difficulty in expressing a given meaning in words, but this is due to unreadiness of language; and a meaning may quickly give place to another meaning, but with practice it can be caught and expressed. Meanings are not transitory in the way that processes are, but are inherently stable; and they are not inherently elusive, as many processes are, but are very get-at-able. They are cut-and-dried, as it were dead things. . . . We can make rough distinctions between groups of processes, but I question whether this is not due, genetically at least, to the fact that the 'group' has been isolated because it had a 'meaning.' There is no gradual development or dying away of a meaning; it is all there at once. A mental complex, on the other hand, as it shows itself to introspection, rises, becomes more or less prominent, dies away; its part-processes and attributes undergo continual change throughout its course.

Observer F.—It is quite true that the meaning of a word or sentence may be different, and logically complete in different stages, at different times. . . . Thus, when the stimulus was the sentence 'What time is it?' the meaning for practical purposes was first present, and then the meaning was realised in more adequate form (in reference to my university work) with the coming up of suitable images. In this sense, then, I agree that meanings may "change and elude the observer." . . . There is also a sort of emphasis within a total meaning: thus the meaning may be emphatically that of 'the letter *d*,' while at the same time there may be a qualification 'on white' or 'on white paper' or 'on a white ground.' If the emphasis shifts, so that the subordinate becomes the principal meaning, there is also, of course, a 'change of meaning.' . . . I have never noticed, however, that meanings overlap or pass into one another; the meaning is, I think, always this or that, at any particular moment. Thus, the word *hide* gave, as report of process, "kinaesthetic sensations as of contraction in shoulder muscles downward in crouching; slight organics in abdomen; then vague visual image of rounded white surface of small extent in front and to the right." The 'then' reads as if there were a sharp break in consciousness; but there was not. On the other hand, the shift of meaning from 'crouch' to 'human skin,' and therewith from verb to substantive, was definite and abrupt. . . .

The difference of type is again apparent. For D, there is no question of 'range of meaning,' of 'logical completeness in different stages;' she assumes, quite as a matter of course, the range set by the requirements of the *Aufgabe*, i.e., by the experimenter; the meaning is hard and fast, without power to contract or expand, and without internal emphasis and subordination. F, on the other hand, reports changes of meaning which at once suggest the logical terms intension and extension. Despite this difference, the observers agree

that change of meaning, unlike change of process, was complete and immediate.

It would, of course, be unwise to generalise these results, though there can be no harm in drawing from them the old lesson that, when we are trying to further psychology, we must be constantly on guard against the irruption of logic. Logical common-sense, *c'est l'ennemi*. If, however, the results are borne out by those of other enquiries, we have a new light cast upon such phrases as "a conflict of meanings," "the meaning of the telegram gradually dawned upon him," etc. During a conflict of meanings, for instance, whatever might be the tangle of contextual processes to be unravelled by introspection, we should have the meanings themselves at any single moment clear-cut and distinct; and the dawn of meaning would not be a gradual and continuous unfolding of meaning, but a step-wise progress involving what I have, perhaps rashly, identified as intension and extension. In both experiences there might be periods of meaninglessness, such as have been found in previous experimental work and have been verified in our own observations; but, if a meaning were present, of whatever logical 'stage of completeness' and of whatever 'range,' that meaning would be self-contained, rounded off, untainted by intermixture of other meanings, replaced by and not dissolving into its successor or alternative.

(3) I come, finally, to the empirical characterisation of the two attitudes.

Observer D.—(1) The statement of meaning is much *easier to make* than is the report of process. There was a definite bodily reaction (slight nausea, inhibited breathing) to giving a long and full account of processes, as if to a difficult, laborious, irksome performance. The statement of meaning, on the other hand, came easily, without effort or unpleasant affection. In particular, (a) meanings are definite, and arrange themselves easily in sequence, whereas it is difficult to be sure of the temporal order of processes. (b) The statement of meanings is comparatively simple; there are fewer meanings than processes; a single meaning often corresponds with a large budget of processes. One is therefore sure of the completeness of a statement of meaning, while one often has the uncomfortable feeling that a process-account is scrappy and imperfect. (c) Meanings seem to go naturally into words; the phrasing takes care of itself. One has to be very careful of one's vocabulary in reporting processes.

(2) The two accounts stand in a different relation to each other. The statement of meaning is altogether *independent*, and can be made without any thought of process. I find, however, that even when I am trying to hold strictly to the attitude of reporting processes I am tempted to refer to meanings, in order to make the description complete and chronological; I resist this temptation, as I am sure that the meanings are extraneous to introspection. Where the statement of meaning (as in some of the new experiments) is given first, it offers

itself as a skeleton on which I may reconstruct the process-account; it promises to give shape and organisation to that account; and I cannot help making some use of it.

(3) Besides these differences of degree, there is also a difference in kind. It is the natural, everyday thing to converse in terms of meaning and it is, for me at least, natural to remember in those terms. While, therefore, the introspective attitude is *analytical*, the meaning-attitude is not analytical (or synthetical) at all, but just matter of course; the expression takes place immediately, without hesitation, as if automatically. It would never occur to me that I might analyse or put together a given meaning; a meaning is a unit, complete in itself, which would not exist if broken up in any way. . . . So I do not 'observe' meanings; the word implies a more active attitude than is correct for meanings; I take the meanings as given to me from without. The difference is, I suppose, one of *Aufgabe*; but it is not the contrast of two kinds of *Aufgabe* within a psychology; when I turn to meanings I drop psychology, and fall into the naive, receptive attitude of everyday life.

Observer F.—(1) *Analytical and non-analytical*. During an experiment, certain processes rise into prominence, have a unity of some sort, seem to 'belong together,' then die down gradually and give place to another group of processes; there may be several of these 'conscious presents.' We can analyse the groups or complexes, and find the individual component processes within the unity; we are able to say that now this and now that part-process came or went. On the side of meaning there is no such possibility; the meaning, as opposed to the conscious complex or conscious present, stands as a unit which cannot be analysed; there is no sense in which it can be regarded as 'made up of' constituent meanings. As a meaning for a definite purpose, it stands as individual and irreducible. . . . This 'belonging together' on the side of consciousness, and 'single direction towards an end' on the side of meaning, are what lead us to make paragraphs or breaks in the twofold report.

We can say that a reported meaning is 'partial,' if we compare it, say, with a verbal definition; but this does not mean that the logically complete meaning can be analysed into partial meanings. We can say also that a meaning shows difference of emphasis; but this does not mean, again, that it is made up of two meanings; the subordinate or qualifying aspect is always integral to the meaning as individual.

(2) *Kinetic and static*. Processes move; they begin and grow and end. They have attributes, and the attributes show continuous change. Meanings are static; they do not proceed or grow; they merely are. They do not possess attributes, as processes do. One could arrange meanings on scales, either of internal emphasis or of extent; but one would then be arranging different meanings; the series would be discrete.

Processes may be present simultaneously, and may run parallel in time. I cannot think of a situation in which two meanings were present at once.

Processes, in such formations as the conscious attitudes, run together into condensations; meanings stand as blocks, with rather sharp breaks between them.

(3) *Observed and acknowledged*. I observe mental processes much as I do physical processes; live the experience through, under *Aufgabe*; and then write down a one-to-one report, so far as that is possible. This comes fairly easily, so far as I have the names at command and am familiar with the processes to be named. Meaning, however, is not

a conscious fact any more than it is a physical fact. Meanings and physical things may be represented in consciousness, but they do not form part of consciousness. They cannot, then, be observed, as processes are, but must be thought out. If the superficial, common-sense meaning alone were required, the meaning report would be easy enough; but when an exact statement of meaning is called for, I have to think it out; to go over the experience again and again, asking myself: Did I realise this? To what extent, for what purpose, did I realise it? I then acknowledge the meaning, as something implied, as a reference of my experience to other experiences under a purposive aspect; I do not observe it, as something existing.

In other words, the difficulty of the report of process is the same that one has in physics; one knows, from other experiments or from reading, that certain things may be overlooked, on account of conditions, or that certain things may be read in, on account of bias. The difficulty is itself familiar, and can be met by a fitting variation or repetition of the observations. An exact statement of meaning requires a very different attitude, one of logical reflection, of weighing possibilities, of setting limits; it is easy to say 'I knew' or 'I felt' or 'I wished' thus and thus, in general terms, but it is very hard to work out how well, how fully, I knew; what was the precise content of the wish, etc. The meaning, as I said, is always a matter of implication; I assent to it, or reject it; I do not observe it. When once the meaning has been found, however, one is sure that one has it all,—a rather rare feeling in reports of complex processes.

(4) *Definite and indefinite.* I have already said that to 'find' a meaning, with any exactness, one must circumscribe one's task; meanings widen out in increasing circles. My own restriction of meaning to 'such meaning as expresses strictly and directly these particular processes' came well toward the end of Jacobson's experiments, and only after I had tried, for some time, to state exactly other and various ranges of 'meaning at large.' With processes the task is quite definite; one is to describe all that are there, or one is to restrict oneself (by instruction) to some group or phase.—

I may summarise by saying that the psychological *Aufgabe* in these experiments was to observe, analytically, a given continuum of processes. The other, and what I should call the logical *Aufgabe*, was to state the meanings which reflection found implicit in certain (practically important) moments of the continuum.

It is clear, I think, that these observers, when asked for an empirical characterisation of the attitudes, sought—as, indeed, how should they not seek?—to psychologise their answers; the empiricism to which they appealed would, naturally, be that of psychology. The result is an attempt to differentiate, in terms of introspection, two attitudes—the one of which lies beyond the scope of introspection. I find it, then, all the more significant that both observers expressly give up the appeal to psychology; D makes the meaning-attitude a non-scientific, everyday matter, and F refers it to logic. But, in point of fact, the appeal to psychology breaks down from the start. Ease and difficulty, analysis and non-analysis, stationariness and elusiveness, definiteness and indefiniteness, all

these antitheses may be found within psychology itself. Their use in the reports, however, plainly transcends psychology. What, for instance, does D mean to contrast under the rubric of ease and difficulty? Not a psychological difficulty and a psychological ease; but rather psychological difficulty in general and a certain non-psychological ease, the facility of ordinary conversation. F, too, does not need to be informed that there are psychological formations, *e.g.*, perceptions, of a relatively static character; when he contrasts 'kinetic' with 'static' he has in mind general psychological elusiveness and general logical stability. And what holds of these, holds also of the other oppositions which appear in the reports.

The reader of the reports themselves will note—and may make the fact a ground of objection—that nothing is said of the carriage of the *Aufgabe* in the fore-period. Here, if anywhere, it might be supposed, a psychological difference between the two attitudes should appear. There is, however, a sufficient reason for its absence. In all psychological experiments of this kind, the *Aufgabe*, as I have remarked in another place, is couched in informatory terms; the observer is 'informed' that he is to introspect; and, responding to the informatory attitude of the experimenter, makes no effort to translate the instruction into terms of description.¹⁵ That is the natural course of events. But let an effort be made to introspect the contents of the fore-period: what have we gained? We simply get, over again, the distinction with which we are familiar from the main period, the distinction of 'report of process' and 'statement of meaning.' The appeal to the fore-period is therefore unavailing.

In conclusion, it may be pointed out that the two observers, in spite of their typical difference, come to substantially the same result as regards the sphere to which the stated meanings belong. D, who takes them the less seriously, tells us that they are the meanings of our daily life and conversation; F, that they are logical meanings. I need not argue that there is no contradiction; but I may remind the reader that Messer, in seeking to discriminate the psychology from the logic of thought, finds a half-way house in "the attitude which we assume in intercourse with our fellow-men."¹⁶

¹⁵ *Thought-processes*, 1909, 268.

¹⁶ A. Messer, *Empfindung und Denken*, 1908, 163 ff. "Es wird sich empfehlen, sozusagen stufenweise zum Standpunkt der Logik emporzusteigen. Am zweckmässigsten werden wir wohl den Ausgang nehmen von dem Verhalten, das wir im Verkehr mit unseren Mitmenschen zu deren Denken einnehmen."

Summary.— It has been recognised, in recent studies of the processes of thought, that the observers' reports contain material of different kinds: introspective description, and information or communication. There is, however, no general agreement as regards (1) the line of division between the two modes of report, (2) the nature of the conscious processes underlying 'information,' or (3) the attitude which finds expression in 'information.'

E. Jacobson (this JOURNAL, XXII, 1911, 553 ff.) requires his observers to distinguish between 'description of process' and 'statement of meaning.' He thus secures (1) a line of division in their reports. He finds (2) that there are no specific 'meaning processes' underlying the statements of meaning.

On the basis of new experiments, I have sought (3) to characterise the attitudes implied in, or demanded by, the two modes of report; the one attitude turns out to be that of descriptive psychology, the other that of logic or of logical common sense. The latter attitude I take to be essentially the same as that involved in Dürr's 'verbal statement' and von Aster's 'communication.'

Certain facts brought out in the course of these experiments indicate that there is a rich field for introspective study in the consciousnesses underlying 'conflict of meanings,' 'the gradual dawning of a meaning,' 'misunderstanding,' 'the inability to make oneself understood,' and so forth.

ANALYSIS OF CONSCIOUSNESS UNDER NEGATIVE INSTRUCTION¹

By L. R. GEISSLER

In connection with reaction-experiments on association and reproduction with normal² and abnormal³ subjects, H. S. Langfeld has recently employed and studied that kind of negative instruction which requires the suppression of the name of a perceived object. The problem of the negative instruction and its relation to recent investigations of the conscious attitudes, the thought-processes, and other similar topics, seemed to us of such importance as to deserve a special and more detailed study for its own sake. Our aim was, therefore, first to repeat Langfeld's experiments with greater emphasis on detailed introspections, and then to introduce such variations of conditions as might be expected to throw further light on the analysis of consciousness under negative instruction and in particular on the nature of the suppression.

The experiments were performed in the Psychological Laboratory of Cornell University during the summer session of 1911, by Mr. F. G. Tappan,⁴ instructor in Electrical Engineering and candidate for the degree of Ph. D. The repetition of Langfeld's experiments was made as nearly identical with the original as possible; the only appreciable difference was that we worked in daylight and had an electric fan-motor running whose faint but constant noise veiled any unavoidable distractions. Among our four observers was Miss L. M. Day, a graduate student in psychology, who had attained a high degree of practice in the experiments on Meaning conducted by Dr. Jacobson,⁵ in the previous year. Another

¹ From the Psychological Laboratory of Cornell University.

² Suppression with Negative Instruction. *Psychol. Bull.*, VII, 1910, 200-208.

³ Suppression with Negative Instruction. *Psychol. Rev.*, XVIII, 1911, 411-424.

⁴ The writer gladly takes this opportunity to thank Mr. Tappan for his skill and patience in carrying out the work, his care and pains in calculating and summarising the quantitative results, and his general interest in the progress of the investigation.

⁵ On Meaning and Understanding. *Amer. Jour. Psychol.*, XXII, 1911, 553-557.

highly practised observer was the present writer, who likewise had taken part in these experiments and who besides had several years' experience in introspective work. The two remaining observers were students of the Summer School, Miss E. Forchheimer, instructor in the department of Education at the Normal College of the City of New York, and Mr. N. M. Sharpe, a senior in Cornell University, who had attended several lecture and laboratory courses in the department of psychology. These four observers had, then, various degrees of practice in introspection; they will be referred to, although in a different order, under the letters A, B, C, and D.

The exact conditions of our first series of experiments were as follows. The observer sat before a large, black, wooden screen behind which in a rectangular opening a picture could be exposed by moving a small cardboard screen, usually covering the opening, quickly and noiselessly upwards. All other surroundings, including the experimenter himself, were hidden from the observer's sight by black curtains. Before every exposure the experimenter read Langfeld's instruction in a calm, indifferent tone of voice. Then he said "Ready," waited a second, gave the signal "Now," and after another second raised the small screen and started the stopwatch. As soon as the observer began to give the associated reaction-word the stopwatch was stopped, and the screen dropped again. Shortly afterwards the observer dictated his introspection, in as detailed a manner as he was able, and if possible in the same temporal order in which the experiences occurred. No questions were asked, except in cases of obvious misunderstanding. As in Langfeld's work, the introspections extended mostly over the mid-period; that is, from the first perception of the picture up to the completed reaction. In a second series of experiments the introspections covered sometimes the fore-period and sometimes the after-period. The observer never knew beforehand what he would be expected to give, as we thought it more important to avoid any kind of change in the contents of consciousness due to such previous knowledge than to facilitate introspective analysis at the risk of varying the state of consciousness by predetermination. The fore-period began with the signal "Ready" and stopped at the first perception of the picture, while the after-period started with the first articulation of the reaction word. The other experimental conditions of this second series of observations were the same as those of the first series.

The principal change in our third group consisted in the substitution of actual objects for the pictures. For that purpose the black wooden screen was replaced by a black curtain behind which the object was placed. The observer's right elbow rested on the table so that the lower arm was also behind the curtain. At "Ready" the hand was raised, while the experimenter silently put the object in its place. At "Now" the hand moved quickly downward, and as soon as it came into contact with the object the stopwatch was set off, and stopped again with the beginning of the reaction. Twenty objects were presented on two successive days in the following order: tennis ball, electric dry cell, pack of loose cards, pocket-knife, electric bulb, scissors, tobacco pipe, teaspoon, comb, spool, watch, shoe-horn, ink-bottle, blackboard-eraser, glass, fountain-pen, cotton-wool, bunch of keys, alarm-clock, pencil. The instructions were modified correspondingly and the introspections extended over the total period from the "Ready" to the end. In the last series, finally, the instruction was reversed into its positive form, to read: "Do not react with any word except the name of the object." The following twenty objects were used: book, saucer, pencil, clamp, pliers, silver dollar, fork, compass, mucilage-tube, toy-pistol, apple, rubber-stamp, nail-file, screw-driver, ruler, marble, checker, cartridge, nail, pencil-eraser.

We may consider first a few quantitative results. The data from the first series agree very closely with those of Lang-

TABLE I. REACTION-TIMES

No. of Series	Obs.	No. of Expts.	Average	MV	Range	S. Ss.*
I.	A	67	1.75	± .40	.9-9.1	67
	B	81	1.60	± .45	.6-7.0	81
	C	67	1.75	± .45	.9-3.4	67
	D	67	1.40	± .40	.6-2.7	65
III.	A	20	2.25	± .65	1.1-4.0	19
	B	19	2.40	± .80	.6-4.2	19
	C	20	2.90	± .80	1.1-4.4	20
	D	19	2.90	± 1.50	1.0-9.0	19
IV.	A	23	2.90	± .70	.7-15.0	—
	B	20	3.50	± 1.85	1.1-12.7	—
	C	23	2.90	± 1.45	.7-9.0	—
	D	23	3.50	± 2.75	.9-17.0	—

* This column gives the total number of successful suppressions.

feld, indicating that the change to daylight conditions had no appreciable influence upon the results. The only noteworthy difference is that three of our observers had no, and the fourth only two, unsuccessful suppressions of the forbidden name of the object. Statistical tables on the frequency of certain kinds of imagery are of no significance for our particular purpose and are therefore omitted, especially as we have satisfied ourselves that they reveal nothing different from those given by Langfeld. The average reaction-time, its mean variation, and its range may be seen from Table I. The same table shows also the average reaction-time, mean variation and range for the experiments of the third and fourth series, in which objects were used. The numbers in the fourth, fifth, and sixth column are seconds.

It is natural that the touch-reactions should be relatively slow, on account of the delayed recognition of the objects by touch; but it is surprising to find the reactions with positive instruction slower than those with negative instruction. The only exception is observer C, whose times are identical in both series, although even here the fourth series shows a larger mean variation and range. The reason for this unexpected difference between the third and fourth series will become plain from the introspections. There is only one unsuccessful suppression in the third series, with A, who reacted to the object fountain-pen with the word pen. In none of our series does the reaction-time show any tendency to become shorter with practice; in fact, some of the maximal times occur toward the end of a series.

Turning now to the qualitative analysis of consciousness under an instruction, as revealed by our introspective records, we may most appropriately begin by a comparison of Langfeld's data with those obtained by us under nearly identical conditions. Langfeld finds "all forms of suppression from a fully voluntary act to a purely automatic reaction," and distinguishes in this development eight different groups or stages, adding, however, that "the different forms are scattered throughout the different days and the different subjects." He would probably not maintain that these groups or stages are the only ones, or that they are all of equal frequency or significance. Our own records verify most of his stages; but we can not find any parallel to his fourth group, in which the recollection of the negative instruction is sufficient to inhibit even the kinaesthetic image of the forbidden name. Some of his illustrations of this group seem to show, however, that the name of the object must have been present in conscious-

ness, if not as a kinaesthetic image, then in some other form. Consider, for example, the following introspection: *Cannon-Gun*. "Idea of cannon. Recalled that I was not to say cannon, so said gun." What is the "idea of cannon" in this case? In other examples, the term kinaesthetic image does not always seem to be used in the same way. In one case we read, for example, "kinaesthetic image of cards. Suppressed it, etc.," and in another case: *Horse-Cow*. "Kinaesthetic image of horse. As to the suppression, the word simply did not come, etc." Here the 'kinaesthetic image of horse' seems to be something different from the word horse, while in the case of the cards the pronoun 'it' refers to the image, and no word is mentioned. Similar cases occur on p. 207: *Teeth-Gum*. "Kinaesthetic image of false teeth. Should have said these words, etc." What, then, is this kinaesthetic image, and what is really suppressed? Langfeld does not describe the suppression itself; his conclusions refer mostly to its development only; how the suppression takes place is not stated. In this respect we believe that our repetitions and variations of Langfeld's experiments form a necessary supplement to his work. In order to give the reader a more concrete idea of the sort of consciousness involved in the reaction to a negative instruction, we have summarised the introspections of our four observers under each one of our various conditions, and have added in footnotes samples of introspections to illustrate points of special significance.

INTROSPECTIONS ON THE MAIN-PERIOD (REPETITION OF LANGFELD'S WORK)

Observer A.

The perception and recognition of the object usually arouse its name in internal speech. Sometimes there is a strong kinaesthetic tendency to say the name, which consists chiefly in actually initiated movements¹ of the tongue and lips.—In 8 cases the name of the object is not in consciousness.

The suppression following is sometimes attitudinal, containing kinaesthetic strains and pressure sensations in the palate, organic sensations and inhibited or irregular breathing, muscular rigidity of mouth and lips and general tension of the muscles involved in articulation (this occurred usually in focal clearness).² Sometimes the suppression is

¹ *Pipe—Tobacco*, 1.2 sec. "Kinaesthetic tendency to say pipe, with lips closed for 'p.' Then vague visual image of Mr. F., leading to verbal idea: 'tobacco—pipe' and said tobacco . . ."

² *Carriage—Wheel*, 1.5 sec. "Internal speech: 'carriage.' State of confusion, eyes moving over picture, mouth half open as if catching my breath, held breath, strong pressure in region of soft palate, tendency to pronounce carriage, at least ready for k-sound as the beginning of this word. . . ."

ideational, consisting mostly of verbal ideas fleeting through the focus of consciousness, as "I must not say so and so," or "What can I say?" or longer comments on possible reaction words, etc.* In later experiments (of this group) the suppression is sometimes replaced by an attitude of hesitation which is analysed into organic sensations from the diaphragm-region, and muscular strains from frowning and vague staring at the picture. The whole attitude is unpleasant.¹²

This stage is sometimes followed by an active attitude of search, consisting of the resumption of strong eye-movements and many verbal ideas, mostly commenting critically on the difficulty of the situation, as "this is absurd," or the like.¹³

The actual articulation of the resulting reaction-word is sometimes anticipated either in internal speech or as a verbal idea. Sometimes, especially when there has been no suppression, the reaction takes place automatically either as the result of a common-place word association, such as table-chair, where table is the name of the pictured object, or as the name of that part of the picture which has been in the focus of both attention and vision.¹⁴ The reaction may be accompanied or followed by feelings of relief, satisfaction, surprise, familiarity, etc. Occasionally verbal memories enter, or verbal ideas either criticising or justifying the reaction-word with reference to the instruction,¹⁵ for example, "this word is all right," "perhaps I ought to have said so and so," etc.

Observer B.

Immediately upon the perception of the object its name arises verbally in auditory-kinaesthetic form. This is followed in the earlier experiments by "incipient" throat, tongue and lip movements, which later drop out while the auditory-kinaesthetic idea of the word remains.—In 15 of the 81 experiments no name of the object is present in consciousness.

Then a "muddled feeling" with inhibition or irregularity of breathing and slight organic nausea occur, while the eyes are rapidly working

* *Violin—Bow*, 1.9 sec. "First thing on sight of picture was 'violin' in pronounced internal speech. Then in verbal idea 'must not say that' and word 'bass' came, but immediately the verbal idea 'this may be a bass, oh what can I say?' Then period of waiting with strong organic sensations about diaphragm and abdominal wall, very unpleasant. Finally, with a feeling of relief, the verbal idea 'oh yes, bow is o. k.' and said bow."

¹² See end of previous introspection.

¹³ *Wheelbarrow—Move*, 1.5 sec. "No name suggested itself. Word 'move' in internal speech was first word after period of search when eyes wandered over picture with occasional fixation, frowning, holding breath, uneasy and unpleasant. . . ."

¹⁴ *Trolley car—House*, 1.1 sec. "Word 'house' was suggested in internal speech by long row of windows before I recognised the picture as a street-car. There was no suppression, only a slight hesitation with vague eye-movements and wrinkling of forehead, all slightly unpleasant. Then repeated 'house' as a reaction-word."

¹⁵ *Pail—Water*, 1.3 sec. "Word 'bucket' in internal speech with tendency to say it and moved lips. Then verbal idea: 'inside of bucket' led at once to pronunciation 'water' with a sort of surprise to myself. Then a feeling of satisfaction, with a mental nod of agreement to it, meaning 'yes, that's all right,' all slightly pleasant."

over the picture.¹⁴ The meaning of all this is: "must not say that word."¹⁵ In later experiments a brief verbal remembrance of the instruction "you are not to name the object" takes its place, and finally itself disappears.

This is followed by a period of search for a reaction-word, consisting of strains in head, much internal speech and unpleasantness.¹⁶ In later experiments the eyes begin to fixate habitually only a part of the picture, as the result of the positive part of the instruction, while the rest of the picture is barely noticed,¹⁷ and the verbal idea of the name of the fixated part occurs with it in auditory-kinaesthetic form, anticipating the reaction.

The articulation of the reaction is often accompanied by a feeling of relief, and usually followed in internal speech by the justification: "this word is all right," implying a reference to the instruction. Toward the end of this series of experiments the habit of naming the accidentally fixated part is so strong that the whole reaction is automatic and just barely conscious. But in difficult situations the earlier conscious complexity returns.

Observer C.

The perception of the object arouses its name, mostly in internal speech, kinaesthetically. Frequently this is accompanied by clear visual imagery of similar objects, esp. those owned or recently experienced by the observer. At the same time many other visual and verbal memory-associations fill the background of consciousness.—In 15 cases no name of the pictured object occurred.

Then follows in some cases either an attitudinal suppression¹⁸ whose main contents are muscular strains from "tightness of the throat" and "incipient" movements to say the forbidden name, or an ideational suppression in kinaesthetic-verbal ideas, as "must not say it" or a partial repetition of the instruction.¹⁹

¹⁴ *Trumpet—Tube*, 2.2 sec. "Word 'trumpet' came right away in auditory-kinaesthetic terms. Decided throat-movements, incipient tongue and lip-movements, inhibited breathing, nausea, rapid working of eyes, all meaning 'must not say.' Looked around for something else, with strains in head, all this unpleasant. Word tube as auditory-kinaesthetic idea came with feeling of relief, mildly pleasant, and deeper breathing. Then said tube."

¹⁵ See preceding introspection.

¹⁶ *Fork—Handle*, 1.5 sec. "Word 'fork' came first in auditory-kinaesthetic idea. No tendency to say it aloud and no suppression. Eyes moved along picture, strains in head, organic complex rather unpleasant and meaning 'hunting for word.' Eyes then fixated handle and this word came to consciousness with feeling of relief."

¹⁷ *Automobile—Wheel*, 0.6 sec. "Eyes fixated at once hind wheel and the word came in auditory-kinaesthetic idea and said it very automatically."

¹⁸ *Corn-ear—Succotash*, 1.7 sec. "Had to suppress 'cob,' which kept ringing in my ears. Was conscious of a breeze in room, of strains in eyes, and of tightness in throat. Could not say anything else, had to grope around for word (Experimenter's note: O made an actual sound like 'ugh'). Then a visual image of white dish of succotash and said it."

¹⁹ *Drum—Stick*, 1.1 sec. "Word drum came in internal speech, then verbal idea 'must not say that.' Fixated the drum-stick and said 'stick' with feeling of satisfaction that instruction was followed."

Sometimes a period of waiting, suspension and search follows, which is not further analysed, but is usually marked by strong unpleasantness.

The reaction is usually the result of fixating and naming in anticipatory internal speech some prominent or peculiar part of the picture or of a visual image of great vividness.²² The reaction is followed by a vaguely pleasant attitude or feeling of satisfaction and by verbal and visual memory-associations.

Observer D.

The perception and recognition are accompanied or followed by the name of the object, occurring either in internal speech or as a kinaesthetic "tendency" in the form of initiated lip and tongue movements.²³—In 5 cases no name of the object occurred.

Then, in a few cases only, a kinaesthetic attitude of suppression occurs, whose clearest constituents are pressure sensations of nervously pressing hands and heels together or of rigidly closing the lips.²⁴ In most cases, however, there is a rich flow of associated ideas (in visual, auditory, and kinaesthetic-verbal terms) of similar objects owned or recently experienced by the observer. Frequently there occurs also a specialised, self-set problem to choose the most appropriate association as a reaction.²⁵

This choice may take place with or without conscious effort or search. Several, mostly unsuccessful attempts were made to name some part of the object.²⁶ The reaction is often anticipated in auditory terms, a few times in internal speech. Sometimes it is automatic. In some instances it is accompanied by a vaguely pleasant satisfaction or an unpleasant feeling of doubt or uncertainty. This leads then to verbal comment of self-criticism or justification of the reaction word.

This summary shows that the mid-period can easily be divided into two or three sub-periods, which we may call the stage of recognition, the stage of suppression, and the stage of search, suspense, or hesitation. This is followed by the after-period with its stage of reaction. In the case of ob-

²² *Automobile—Steering-wheel*, 2.0 sec. "As soon as I saw picture visualized a red car I had seen recently. No name of object in consciousness. Visual image of the steering wheel came as part of the whole and esp. vivid as my eyes fixated that part of the picture, then reacted."

²³ *Electric fan—Breeze*, 2.2 sec. "Word 'electric fan' came in internal speech and almost said it, had some effort to suppress it by closing lips. Then word 'breeze' came automatically, perhaps because I had used it in previous introspection."

²⁴ See preceding introspection.

²⁵ *Automobile—Fast*, 2.5 sec. "Said 'automobile' in internal speech and tried to think of a manufacturer. Made effort to find one, pressing of thumbs and contraction of toes, was conscious of wasting time to find name of manufacturer, with a feeling of embarrassment. Finally the word 'fast' came automatically without choice and no internal speech with it. Also needed no effort of suppression."

²⁶ *Piano—Steinway*, 0.9 sec. "Said 'piano' in internal speech and 'Steinway' came at once because my piano at home and one here is Steinway. Had intended to describe part of picture, but cannot do it, either forget it or am unable to do it."

servers A, C, and D, the second and third stages gradually merge into each other, while with B the second stage drops out entirely, because this observer tended to neglect the negative aspect of the instruction and fell into the habit of always naming a part of the exposed picture (in accordance with the positive part of the instruction: "you may describe it or name any of its parts"). In his second article²⁸ Langfeld finds the same tendency occurring among his observers, so that he now omits the relevant passage in the instruction.

The first point of significance in our introspections is that the negative instruction does not inhibit the rise of the forbidden name into consciousness. There are only 43 cases out of 282 experiments, that is, about *fifteen per cent*, in which no name of the object occurred; and some of these are due to failure of recognition. The structural form in which the name appeared varies both in kind and in degree. In a few extreme instances real movements of articulation are made and the first letter is actually pronounced. More often, however, the articulatory movements are only initiated by bringing the vocal organs, as the palate, tongue, teeth and lips, into the right position for pronunciation. This requires usually a few very delicate movements, neither visible nor audible to another person, and an interruption of breathing, especially after inspiration, the "catching of one's breath," with its kinaesthetic-organic effects. This sort of experience is called by some observers "incipient pronunciation," by others a kinaesthetic "tendency" to pronounce the name. It shades off by degrees into "internal speech," where most of the kinaesthetic constituents have lost their sensory and assumed an imaginal character. This telescoping and abbreviating process makes it possible that internal speech usually involves more than one word, so that more or less complete grammatical sentences occur in it. The organic sensations are still present as a vague, unitary complex, although actual respiratory disturbances are rarely perceived by the observer himself. As soon as all kinaesthetic elements have given way to corresponding images and all organic remnants have dropped out, the name of the object is said to be a mere "verbal idea." Often auditory images of the sound of the word fuse with it, and the whole complex becomes rather vague and flashlike. Together with the visual perception and an occasional vaguely pleasant feeling of familiarity, it constitutes the recognition-stage. The observers experience no

²⁸ Ibid., p. 411.

difficulty in detecting the presence of the forbidden name and in distinguishing between its various kinds and degrees of complexity. It is evident from the results that a successful suppression does not mean the prevention of the occurrence in consciousness of the forbidden name, or the breaking up of the associative tendencies between the perception and the verbal name of an object. It might be possible to reach this stage after many months of continuous practice; but even then the result would be due, not so much to the force of a negative instruction, as to the substitution of other associational habits, set up either by a positive element in the instruction or by a new special task which the observer intentionally assigns himself.

The failure of the negative instruction to keep the forbidden idea entirely out of consciousness is counterbalanced by the successful suppression of the motor discharge; that is, the inhibition of the reaction of articulation. This effect is brought about in two different ways, which may be called the *attitudinal* form of suppression and the *ideational* form of suppression. The former consists mainly of kinaesthetic strain and pressure sensations in the back of the mouth, by some called "tightness of the throat," and probably identical with the "locking of the muscles of the throat" mentioned in Langfeld's reports,²⁸ of general bodily tension and rigidity about the lips, and of inhibited breathing, especially immediately after inhalation. The strong pleasant feeling of relief often accompanying the reaction is due to a sudden, almost explosive loosening of this muscular tension. In the case of A the release of the throat-setting frequently resulted in reactions beginning either with a guttural sound, such as carriage, gas, Gordon, clock, etc., or with a sound due to the previous position of the speech-organs as locked after initiating the forbidden name, for example, drum-pipe, saw-hammer, ship-boat, etc. Similar instances occur also with other observers, as the introspection 21 with D seems to show. In the case of D the muscular tension due to suppression is usually more widespread. The following is an illustration of an extreme case: *Typewriter-Hamilton*. "On sight of picture said 'typewriter' in internal speech and tried to think of manufacturer of one. Was not conscious of suppression of 'typewriter.' Said 'Hamilton' but was not sure that it was the name of any when I said it. Am not sure now

²⁸ One of his observers writes: "active suppression by slight locking of the muscles of the throat," and another says: "suppressed it by closing the mouth and putting the tongue against the roof of the mouth."

concerning the suppression, *because remember the contraction of toes and striking the heels together and moved nose up*. Had no visual image of typewriter, but was conscious of intricate mechanism, have never seen one like this."

The ideational form of suppression consists chiefly in some verbal repetition of a part of the instruction, as "you are not to name the object," or in phrases like "wonder whether so and so is all right," "perhaps so and so might do," etc., or in the words of Langfeld's observers: "thought I should not say it," and the like. These ideas issue immediately in the stage of search, which in its briefest form is made up of eye-movements over the picture, restlessness, and further verbal ideas, all toned unpleasantly, until some particular idea or internal speech lends itself to a reaction-word which is finally pronounced. In this connection it is noteworthy that, if such ideas occur immediately upon the naming of the picture, the observers remark explicitly that no suppression was required, presumably because the idea of the name of the object is so intimately associated to the subsequent ideas as to lead at once to them. This is, for example, the case with such common-place associations as chair-table, etc. Here, then, as well as in the ideational form of suppression, the immediate motor discharge of the forbidden idea is directed into other ideational channels and thus delayed and changed; but the entire absence of an idea of instruction leads the observers to the statement that there had been no suppression. They thus imply that the idea of the instruction "must not say so and so" acts or functions as a suppression, or better inhibition, of the motor discharge, and conversely, that the attitude of suppression means the same thing as the idea "must not say it." Indeed, this fact of identity in meaning is explicitly mentioned by B, and there is no doubt in the writer's mind that, if the other observers had been asked whether there was any meaning in the attitudinal suppression-consciousness, they would have given the same answer. At least, the writer is clear in his own case; and the introspection on 'typewriter' by D, quoted above, can fairly be interpreted in the same way. Here the first statement of the absence of suppression is afterwards corrected because of the recollection of the attitude. From Langfeld's introspections several instances can be quoted that confirm this position; for example: *Comb-Hair*, ". . . locked the muscles of the throat after thinking that I must not say the word"; or *Sleigh-Ride*, ". . . thought I should not say it. Locked muscles and then said ride." It is true that these

two characters of the act is now the character brought in by the introduction of its verbal processes in thinking was carried out by the words. Thought suggests that they were substituting thinking rather than giving an additional dimension.

From our two previous chapters it is clear that the attributes of consciousness include the act itself, "I must not say it and it" as the phenomenal experience. Thinking is the case of the attribute that is carried by an organic-experiential complex. The two are the same thing looked at from two different points of view. Indeed from that of logic and that of psychology. Therefore the following analogy will help in an understanding of the difference in statement. Suppose that if a dog really is like a similar organic-experiential complex could be observed at the critical moment in some sort of gesture made by the master or in some more visual stimulus and that it really should prevent the dog from barking. Should we be willing to attribute to the dog's consciousness the thought "I must not bark"? We may be perfectly willing to admit that the dog has sensations and sensory-complexes similar to ours and we should consider it absurd to assume that the dog's mind could interfere in experience from such different points of view as those of logic and of psychology. Even the human mind still finds difficulty in recognizing and separating the two statements. The difficulty is enhanced by our use of words and verbal ideas because in this case the experience considered merely as a symbol or repeated word is so intimately interwoven with the meaning of the word that only the most subtle processes of abstraction can distinguish between the purely existential or psychological and the logical or rather theological aspect of the same experience. The climax of this difficulty, however, comes when the verbal idea has reached such a degree of degeneration, abbreviation or condensation that terms are no longer intended as descriptive of the actual event as to make its original sensory content its elementary cause, unrecognizable. At this stage the verbal ideas seem to be reduced to a single unitary, unambiguously uninterpretable type which has been designated "imageless." Unfortunately the term "imageless thought" seems to imply either that there are experiences which cannot be looked at from any other point of view than the logical because these experiences or thoughts have no existence aside from their meaning or else that these imageless thoughts have a structural character of their own which is neither sensory nor imaginal nor abstract.

If the first implication is accepted, then psychology has nothing to do with these experiences; they lie outside the sphere of psychology; they present no psychological problem; they may obey logical laws, but they have no attributes of quality, intensity, duration, etc., corresponding to those of the processes of mind. If the second implication holds (and most of the American upholders of imageless thought seem to favor it), then introspection should be able to reveal the structural character, and language should find a positive name for it that is free from the reference to logical meaning and avoids the nondescript negative 'imageless.' So far the upholders of imageless thought have failed to give us an analytical description, which alone can entitle it to equal rank with the other mental elements. At any rate, our own introspective analyses of suppression clearly demonstrate that there is no new mental process added to the attitude in order to make it mean "must not say so and so."

All that is needed to bring out this meaning is a change from the psychological-descriptive to the logical-indicative point of view. The change is so easily made and in fact is so natural to an unpractised, uncritical observer that the confusion or mixture of *Kundgabe* with description is the rule rather than the exception. Our records furnish many illustrations, especially with C and D. Their earlier introspections are almost entirely *Kundgabe*; gradually more and more descriptive terms are introduced. A and B, on the other hand, begin with minute analyses, and later refer by general, indicative terms to complexes once analysed. Both kinds of report therefore need interpretation, but different kinds of interpretation. With A and B it is merely a matter of substituting complete formulae for short symbols, while with C and D a reconstruction is required, a translation of indicative into descriptive terms, which is rather dangerous as it tempts the interpreter to substitute his own analysis for the observer's words. For this reason the writer has presented the introspections in greater completeness than would have been otherwise necessary, and thus the reader can judge for himself in how far the dangers of interpretation have been avoided.

Apart from the relation of our introspections to meaning and imageless thought, they have established the fact that the suppression, whether as attitude or as idea of instruction, is successful in inhibiting the articulation of the forbidden name, but cannot prevent its appearance in consciousness in one form or another. The reason for this fact will be better

understood after we have considered the introspections on the fore-period, which are summarised and illustrated below.

INTROSPECTIONS ON THE FORE-PERIOD.

Observer A. (35 experiments.)

While listening to the instruction and at the signal "Ready" there is a strong, staring fixation of the small screen where the picture is expected. At the same time such verbal ideas as "What will it be?" occur in the background of consciousness. At "Now" a slight organic excitement sets in with brief suspension of breathing. The speech-organs are now rigidly set for a quick reaction, and the body assumes a general strained position of readiness. Just before the screen is raised there is a flashlike verbal memory of the instruction in abbreviated internal speech, "you are not to name the object." With the first upward movement of the screen there comes a short, slightly pleasant relief from the strains of fixation, the eyes usually following the screen a short way before perceiving the picture. The signals are often followed by auditory after-images.¹⁷

In later experiments the fixation is less strict, the signals are barely noticed, while the strains of rigidity, frowning, etc., become less intense, and the respiratory irregularity gradually disappears. The instruction is still briefly repeated, but now between the two signals. Everything is much reduced in clearness and intensity.¹⁸

Finally, fixation is entirely given up. A vague, general kinaesthetic consciousness of the bodily position forms a passive, calm attitude of waiting. The organic elements and repetition of the instruction drop out.¹⁹ The whole period has practically no focus of attention, save that occasionally some auditory element rises momentarily to slightly greater intensity and clearness.

Observer B. (36 experiments.)

At first the signal "Ready" sets up a widespread bodily reaction consisting of changed breathing, slight organic nausea, kinaesthetic strains, and fixation of small screen. There are also auditory-kinaesthetic verbal ideas or internal speech, such as: "wonder whether this will be fore-period or after-period," All this is unpleasantly toned. At "Now" the body becomes rigid and the throat is set for reaction. During this part there occurs sometimes a "vague awareness of the original instruction" or a "general awareness of what to do."²⁰

¹⁷ "Staring fixedly at screen. At 'Ready' heard stopwatch, and was vaguely conscious of some organic complex in connection with breathing. Do not remember hearing 'Now.' Just before raising of screen a vague, verbal memory-idea of instruction 'must not name picture.'"

¹⁸ "Passive, calm attitude of waiting. Slight kinaesthetic strains of readiness. No special fixation. 'You are not to name the object' repeated in internal speech. Then 'Now' and stopwatch heard together, barely noticed."

¹⁹ "Very passive, blank attitude of expectancy. Barely heard signals. Was vaguely conscious of bodily position. No focus of consciousness."

²⁰ "At 'Ready' fixated center of screen hard. Had vague visual image of some object there. Vague feeling of Aufgabe 'must not name.' Mild excitation with disturbed breathing and a little nausea. Slight strains in head. Rather unpleasant. Then 'Now,' felt body getting rigid, with eyes still fixated on spot."

In later experiments the excitement due to the uncertainty as to which period will have to be reported disappears. The "Ready" signal is now followed by an abbreviated repetition of the instruction in internal speech, and by a vague organic-kinaesthetic attitude with strains in the head and about the eyes, corresponding to the raising of the screen and slight inhibition of breathing. At "Now" there are a slightly increased tension of fixation and a vague realisation of what to do.²¹

Still later the repetition of the instruction becomes vaguer, more abbreviated and automatic.²² Toward the end of the series it is sometimes entirely omitted. The bodily attitude is now one of calm, passive relaxation with the feeling of security, while fixation remains steady.²³

Observer C. (46 experiments.)

At the signal "Ready" a strained, organic-kinaesthetic attitude of concentrated expectant attention is taken up and the small screen fixated. Then a part or the whole of the instruction is repeated either auditorily or in internal speech, sometimes interrupted by the signal "Now."²⁴ Often an auditory after-image of the signal occurs.

This state of consciousness gradually changes into a passive attitude of waiting, with a feeling of ease and fixation of the screen. The repetition of the instruction is now often omitted, and its place is sometimes taken by an automatic-verbal repetition of the signals.²⁵ In some cases the interval between the signals is described as a conscious blank with no mental processes in the focus of attention.

Observer D. (34 experiments.)

The reading of the instruction has become so tedious and unnecessary that it arouses a strong feeling of impatience, expressing itself in general bodily restlessness, pressing the hands together, drumming on the table, and in verbal comments, as "yes, I know that," "go ahead," etc., carried in auditory-kinaesthetic ideas or in internal speech.²⁶ The instruction is therefore hardly ever repeated by this observer. The signal "Ready" is interpreted as a question, frequently answered with

²¹ "After 'Ready' vague awareness of *Aufgabe* in kinaesthetic and organic sensations. Bodily attitude of tension, strains in head, and inhibited breathing. Kinaesthetic strains in eyes corresponding to the expected raising of the screen."

²² "Repeated automatically 'you are not to name the object.' Passive attitude, calmly waiting. Feeling of security that I should do the right thing."

²³ "Automatic repeating of word 'Ready.' Fixated the spot where picture would come, waited in relaxed state."

²⁴ "Strain sensations from sitting up straight in attitude of waiting. At 'Ready' and 'Now' concentrated attention on screen. In auditory terms 'do not name object.' Then saw screen rising."

²⁵ "Heard 'Ready' again as an auditory after-image. Then a conscious blank. Then 'Now,' and repeated it in auditory verbal terms, until the screen rose."

²⁶ "Rather impatient. Said 'yes' in internal speech and noticed peculiarity in experimenter's voice. Attitude of expectancy. Was conscious of the pause between 'Now' and rising of screen, with feeling of waiting."

"yes" in internal speech, or with an actual or a "mental nod."²⁸ This is accompanied by a general kinaesthetic attitude of readiness with strained, expectant attention, and fixation of the screen. The signal "Now" excites a mildly pleasant interest and occasionally gives rise to verbal ideas of comment on the length of the interval between signals, on the experimenter's voice, etc., until the screen is raised.²⁹

Toward the end of the whole series verbal ideas seem to be the only prominent items left; everything else seems to drop out entirely or to recede so far into the background of consciousness as to be unnoticed.

In connection with these introspections it is important to recall the exact words of the instruction. "Shortly after you hear the word 'Now' a picture will be exposed in the square opening. You are to speak the first word suggested to you by the object in the picture, unless it is the name of this object. You are not to name the object, but you may describe it or name any of its parts. For example, if it is a cow, you may say small, old, head, etc. After the word is spoken you are to give the results of a careful introspection. Pay particular attention to the processes of suppression and association and to the imagery." It will be seen that this instruction involves four factors which refer to the future: (*a*) it calls for the first word suggested by the picture; (*b*) it requires the avoidance of the name of the object; (*c*) it suggests the use of descriptive terms or the naming of parts; and finally (*d*) it calls for introspections. In the light of Ach's work and the results of the Würzburg school we must assume that these four factors set up four different determining tendencies, which we shall designate as the *a*, *b*, *c*, and *d* tendencies. We need not now make any further assumptions as to their exact nature or their neural substrates, but refer the reader to Titchener's discussion³⁰ of these tendencies. The *a* tendency, if occurring in isolation from the others, will most naturally resolve itself in giving the name of the object, because under ordinary circumstances this would be the most frequent course of events. At any rate we can safely assume that the name of the picture occurs among those associated processes which are set in some sort of readiness by the *a* tendency. In the case of observers C and D this readi-

²⁸ "Feeling of impatience. Said 'hurry up' in internal speech. Drew breath and pressed hands together. Then fixated screen."

²⁹ "At 'Ready' feeling impatient at repetition of instruction. Said 'go ahead' in internal speech. Was conscious of shorter interval between 'Now' and stimulus. Mild interest. Kinaesthetic sensations from fixation of screen and vague general tension of body due to attentive attitude."

³⁰ Lectures on the Experimental Psychology of the Thought Processes, 1909, pp. 107, 111, 127f., 163, 174, 246f.

ness is sometimes so great as to cast a strong reflex light into the consciousness of the fore period; both observers mention the occurrence of vague ideas that might be used as reaction-words. From the previous discussion it will be remembered that the mid-period of the same two observers was often filled with visual and verbal associations aroused by the picture, and that in their case the attitudinal form of suppression was both less marked and less frequent. Conversely, we find in the fore-period of A and B an attitude remarkably resembling that of the suppression in the mid-period. There are the same organic excitement and irregularity of breathing, the same rigidity of the speech-organs, and the same sort of general bodily strains. The observers do not recognise the similarity at the time of experimentation; nevertheless we believe that these mental processes are a reflex light cast by the *b* tendency into the consciousness of the fore-period, similar to that thrown by the *a* tendency in the case of C and D.

The reasons why A and B should not recognise the similarity are not far to seek. In the first place, during the fore-period there is nothing to be suppressed, or in other words there is a different conscious context. In the mid-period the attitudinal processes occur in the presence of the picture and the idea of (or tendency to say) the forbidden name, while in the fore-period the same processes occur in connection with the sound of the signals, the verbal repetition of the instruction or at least of the signals, and the staring fixation of the small screen. The immediately following movement of the screen and the accompanying temporary relief interrupt these attitudinal processes. In the second place, the simultaneous verbal repetition of the instruction already carries the meaning "must not say it," so that the attitudinal processes in their new context may assume another meaning which prevents their recognition as a suppression. Their meaning during the fore-period may be summarised in the word: expectancy, in accordance with the interpretation explicitly or implicitly put on them in our introspective records.

Nevertheless it is significant that the working out of the *b* tendency as set up by the instruction is at least partially anticipated in the fore-period in both the forms in which it is later to be realised. This need not surprise us, because it lies in the nature of a determining tendency to prepare for future operation all those processes which have any connection with the idea of object, in our case with the idea of the forbidden name. Which of the two forms of suppression will actually occur in the mid-period depends, according to

our results, upon the degree to which the name of the object is present, as is shown in Table II.⁴⁰ The figures indicate the frequency with which a certain conscious structure of the forbidden name is suppressed in the ideational or in the attitudinal form or not at all; for example, B suppressed the internal speech of the name four times by the idea of instruction, seven times by the attitude, and twice not at all. In order to change these figures into percentages, add half their value for A, C, and D, and one-fourth for B. It will be seen at a glance that C and D had the largest number of no suppressions, because in their case the *a* and *c* tendencies supplied many associations from which to select a reaction-word. The table also shows that the kinaesthetic tendency and the actual initiation of articulation required in every case the attitudinal form of suppression, while the verbal idea of the name was suppressed merely by the idea of instruction; only when the name occurred in internal speech do we find sometimes the ideational and sometimes the attitudinal suppression.

In his second article⁴¹ on negative instruction Langfeld reports introspections on the fore-period from which he draws

TABLE II. RELATION OF CONSCIOUS STRUCTURE OF FORBIDDEN NAME TO KIND OF SUPPRESSION

Kind of Suppr.	Obs.	Verbal Idea	Internal Speech	Kinaesth. Tendency	Initiated Articulation	No Name
Ideas	A	6	9	—	—	—
	B	13	4	—	—	—
	C	7	7	—	—	—
	D	6	3	—	—	—
	Total	32	23	—	—	—
Attit.	A	—	23	5	2	—
	B	—	7	12	2	—
	C	—	2	4	3	—
	D	—	13	3	—	—
	Total	—	45	24	7	—
No. Ss.	A	7	7	—	—	8
	B	25	2	—	—	15
	C	19	10	—	—	15
	D	18	16	1	2	5
	Total	69	35	1	2	43

⁴⁰ The data for this Table are furnished by the experiments of the first series.

⁴¹ *Ibid.*, p. 424.

the following conclusion: "Introspection on the fore-period showed no evidence of the necessity of translating negative into positive instruction. This makes it probable that there is a distinct negative as well as positive attitude, which in most instances can be described solely in terms of cortical set." Our results fully verify this statement, although we should hesitate to use the term "negative attitude," because it might give the misleading impression that the mental processes constituting this attitude can be either positive or negative. It is hardly necessary to point out that the logical meaning or purpose of the attitude may be either positive or negative, while its structural constituents, psychologically considered, can only be either present or absent. The concepts positive and negative are valid for logic, since they refer to the meaning and not to the existence of an experience. In the term "negative instruction" the adjective is not ambiguous because its reference to the meaning of the instruction is evident. In the case of the word attitude, however, the reference is doubtful, because this concept itself has only recently been introduced into psychology as a technical term, and because 'attitude' need not always have a logical meaning.

We can point out only in passing the gradual change in the fore-period due to the frequent repetition of the same situation. Our introspections illustrate in some detail the gradual progress of telescoping or abbreviating a rich or complex and highly organized or differentiated consciousness into a seemingly simple and unitary experience, such as is indicated by the term 'conscious blank.' Some of the original constituents drop out entirely, others become more fleeting and vaporous, some change from a sensational to an imaginal character, all lose in intensity, and the total consciousness falls to lower and lower levels of clearness, until in extreme cases no focal processes remain and we experience a one-level consciousness or the 'conscious blank.' The latter is a rare and extreme event in everyday life, because as a rule novel mental processes rush in and take the opportunity to rise to the focus of attention, that is, to the point of greatest clearness.

INTROSPECTIONS ON THE AFTER-PERIOD.

Observer A. (36 experiments.)

The reaction is sometimes accompanied by a more or less distinct and clear consciousness of the reactor's own voice in kinaesthetic, tactual, and auditory sensations. At other times the reaction is set off so automatically by the previous position of the speech-organs that the ob-

server does not know what he is going to say or that he is speaking. Usually the reaction is accompanied or immediately followed by a feeling of relief made up of decreased strains from fixation or eye-movements, from frowning, and from relaxation of rigidity of the body and the speech-organs, and of organic sensations from resumption of regular breathing, sometimes marked by a faint sigh. This consciousness is quite pleasantly toned.²⁴ As a rule it is followed by a rush of verbal ideas, especially in the abbreviated sentence-forms, which contain both the name of the picture and the reaction-word just given, as "the kite is in the sky." Often these verbal ideas are of the nature of critical comment on, or justification of, the reaction-word. Now and then the observer asks himself the question: "Why did I say so and so?" These verbal ideas together with an organic attitude of satisfaction constitute a vague reference to the instruction successfully carried out.²⁵ In a few instances memories of similar pictures, reaction-words, or situations terminate this period.

Observer B. (37 experiments.)

After the reaction a feeling of relief arises due to relaxed fixation, renewed "eye-movements, and change in bodily position or "settling back." Sometimes the reaction-word is automatically repeated in internal speech while the eyes move about. In some cases the reaction-word is different from that intended or anticipated in auditory-verbal ideas and surprises the observer.²⁶ In such cases the speech-organs are set off either by the fixation of a part of the picture or by some sort of kinaesthetic explosion, rather than by ideational processes. Many other auditory-kinaesthetic processes follow, some expressing wonder why such or such a word occurred, others justifying or criticising it. They are frequently accompanied by a vague feeling of satisfaction and hint at the fulfilled instruction in some indefinite, as yet unanalysed way.²⁷ Further internal speech and sometimes visual-kinaesthetic memories bring this period to a close.

²⁴*Bicycle—Air*, 4.6 sec. "Said 'air' with distinct kinaesthesia of my throat-movements. Did not know what word would come out when I commenced to talk. Felt a pleasant relief in making an ejaculatory sound. Then wondered in abbreviated internal speech why I said air, and further verbal ideas on length of reaction-time."

²⁵*Ship—Sky*, 1.9 sec. "I had fixated upper part of picture and now named it automatically. Then eye-movements over the rest of the picture. A sort of vague comfortable attitude of agreement or acceptance, as if justifying my reaction."

²⁶*Pear—Stem*, 1 sec. "At 'stem' eyes fixated it. Then auditory-kinaesthetic verbal idea 'you did not name the object.' Feeling of satisfaction that Aufgabe was fulfilled. Eyes began to move away from picture and strains of fixation relaxed."

²⁷*Locomotive—Whistle, well, well!* 1.1 sec. "Word 'whistle' came out automatically. Had intended in internal speech to say 'wind.' Was very much surprised at my saying whistle. I had also an auditory image of words wind and smoke as I said whistle. Then realised what I said. Your kinaesthesia gets ahead of the intellect."

²⁸*Church—Steeple*, 1.2 sec. "After saying 'steeple' a mild vague feeling of satisfaction that I had done this all right, and had gone through nicely. Attitude of relaxation and mild relief. No particular images."

Observer C. (43 experiments.)

The reaction is usually followed by a kinaesthetic feeling of relief due to the cessation of strains from straight, rigid bodily position and from fixation. Frequently the train of visual and verbal memories started during the mid-period lasts until after the reaction, enhanced by new visual, kinaesthetic, tactual, and auditory images suggested by the reaction-word. Sometimes there is a vague feeling of satisfaction at having obeyed the instruction. Toward the end of the series the reaction-word is occasionally followed by a conscious blank with nothing but the feeling of relief in the background of consciousness.

Observer D. (29 experiments.)

The feeling of relief closely follows the reaction-word, is made up mostly of kinaesthetic sensations due to cessation of previous strains,¹⁰ and is toned slightly pleasantly. The reaction-word itself arouses visual and verbal memories, and sometimes the feeling of satisfaction at having followed the instruction, especially in doubtful or difficult cases.¹¹ Toward the end of the series the reaction becomes more automatic and the whole period very poor in associational and other contents.¹²

Two significant results are to be derived from these introspections. The first point holds particularly with observers A and B and refers to those instances where the reaction-word is set off kinaesthetically by the locked position in which the speech-organs are found to be, as a result of the previous attitude of suppression. The introspections on the mid-period have shown how the *a* tendency set up by the instruction is prevented from working itself out into a motor reaction if it conflicts with the *b* tendency. As soon, however, as the *b* tendency has realised itself by suppressing the forbidden name, the *a* tendency seems to resume its work by bringing into consciousness other associations set in readiness during the fore-period, and thus it will finally lead to a reaction. Frequently it is aided by the *c* tendency, which may sometimes develop into a habit of naming automatically a part of the picture. In some cases, however, especially when the attitudinal suppression is particularly strong, the inhibitory effect of the *b* tendency seems to extend over all the

¹⁰ *Pear—Leaf*, 3 sec. "Visual image of pear from own tree at home. Kinaesthetic and gustatory sensations of eating one with feeling of grain in it, like goose-flesh."

¹¹ *Ball—Play*, 1 sec. "Feeling of relief at saying play. Relaxation due to cessation of kinaesthetic effort of mid-period."

¹² *Cow—Milk*, 1 sec. "Kinaesthetic sensations due to closing of eyes as if I had finished my task and deserved a rest. Sigh of relief. Then in internal speech critical analysis of picture, noticed hump on top of head which looks like a hat."

¹³ *Pear—Eat*, 1.1 sec. "Pleasant feeling of satisfaction and certainty from kinaesthetic sensations in neck and head due to nod, meaning I had done the right thing."

processes prepared by the other two tendencies, and as a result no ideas rise into consciousness to start a reaction. Under these conditions all the nervous energy seems to become concentrated in the organs of articulation, where it finally accumulates force enough to break through the blockade, and thus to lead to some sort of random movements which finally shape themselves into the pronunciation of an actual reaction-word. The observers A, B, and C describe this state in the following ways, respectively: "made babbling and stumbling articulatory movements before word came"; "your kinaesthesia gets ahead of the intellect"; "groping for a reaction-word, stuttering and keyed up to speak." In the light of our introspections we feel tempted to read a similar occurrence into Langfeld's example *Collar-T-tie*. In our own instances the observers add that they are speaking before knowing what they are going to say, their reactions are forced, involuntary, or unintentional, that is, the word is not anticipated in any conscious form whatever. The beginning of the reaction-word itself seems to indicate that it results from the sudden release or explosion of the restrained speech-organs. The sudden muscular relaxation together with the rush of air from the resumed expiration produce vocal sounds which shape themselves into words, while their initial letters indicate where the suppression had been most intense. If, for example, the attitude of suppression involves the tight closing of the lips, the reaction is apt to begin with labials; if the palate is most involved, the guttural beginning is more liable to occur; if the tongue is pressed against the roof of the mouth or against the front teeth, the words may start with such letters as s, t, th, etc., as in Langfeld's *T-tie*.

The other significant fact brought out by the introspections on the after-period is the frequent occurrence of a pleasant feeling of satisfaction "that the instruction was carried out successfully," "that the reaction-word is all right," etc. This feeling is sometimes accompanied by a train of verbal ideas whose meaning is either a criticism or a justification of the reaction-word with reference to the instruction. In other words, the mental processes of the after-period are still under the influence of the determining tendencies set up by the instruction. Here, however, the influence seems to be mostly physiological, and the reflex light which it throws into the consciousness of the after-period is so dim and ill-defined that a more minute analysis or description under our conditions of experimentation is impossible.

In this connection it may not be out of place to attempt a reconstruction of the physiological or neural mechanism which seems to underlie the two forms of suppression and their resultant association-reactions. This hypothetical reconstruction is purposely couched in the most general terms, because we do not wish to commit ourselves to any histological theory of the nervous system. It seems plausible to assume at the outset that a determining tendency may be set up by an experience if the neural process serving as the substrate of that experience does not conduct all its energy along some definite path, whether intracortical or efferent, but radiates at least a part of its energy diffusely over a larger cortical region. This region is thus thrown into a general but low degree of excitation, sometimes called a "cortical set." We may perhaps think of the diffusion as a storing up of potential energy. Any future stimulus that excites some neural process within this region will find its way prepared, and will therefore require less neural energy to set the process into function. It may also be possible that occasionally the rest of the region contributes its potential energy to the excited process, and thereby enhances the latter's activity or helps it to discharge itself along some new definite neural path.

We assume now that in our experiments the listening to the complex instruction sets up not only one, but several such determining tendencies. The first or *a* tendency, to give the first word suggested by the picture, prepares a cortical set or constellation of neural processes any one of which would issue ultimately in an efferent current leading to the pronunciation of the realised idea. Among these potential neural processes is one corresponding to the name of the object expected. The second or *b* tendency, not to say the name, prepares a cortical constellation which in one respect agrees with the first, namely in as far as it also involves the neural substrate of the name. On the other hand, this *b* tendency, if realised in isolation from the others, would lead to a closing or tightening up of all the muscles involved in articulatory speech. The third or *c* tendency, to describe the object or to name one of its parts, likewise to some extent overlaps the first tendency. If we try to represent this relation by a spatial schema (without assuming, of course, that its cortical parallel is necessarily or mainly spatial) we might think of three circles *K*, *L*, and *M*, arranged so that *K* and *L* cover the same area *x*, while *K* and *M* have in common the area *y*. In the area *x* there occurs the neural process corresponding to the forbidden name. As soon as the stimulus occurs, the neural process common to the first and second tendency is excited, and the forbidden name rises into consciousness and starts two efferent currents, the one in accordance with the *a* tendency to issue in the pronunciation of the word, and the other in accordance with the *b* tendency to prevent articulatory movements. If the two nerve-currents started exactly simultaneously and were of equal strength, no movement of either kind could take place, and we should probably remain unconscious of any tendency to speak or to suppress speaking. We must expect, however, that such a perfect equilibrium, if at all possible, is very exceptional. According to our introspections the *a* tendency seems to have more or less of an advantage over the *b* tendency, at least at the very beginning, and thus it is able partly to realise itself before the *b* tendency becomes effective. While the latter is now spending its energy on the locking of the speech-muscles, the other cortical regions originally aroused by the *a* tendency come into play, probably stimulated by neural processes corresponding to the continuous sight of the picture and perhaps also aided by the *c* tendency, or conversely, until another

neural process has accumulated energy enough to issue in a new efferent current leading to a new reaction-word. Sometimes this second reaction seems for some reason to be delayed, while the energy of the *b* tendency is being used up, and finally can no longer restrain the articulatory muscles from moving. Under the guidance or modifying influence of the belated *a* or *c* tendency the random movements finally issue in the pronunciation of the new reaction-word.

In the case of ideational suppression the neural mechanism seems to be somewhat different. It will be remembered that here the forbidden name arises only either as verbal idea or in internal speech, and very frequently the observers mention explicitly the absence of any tendency to pronounce the word. We must assume, therefore, that the cortical substrate of the ideated name does not issue in an efferent nerve-path, but is conducted into other central nervous processes which as the substrates of the ideated instruction belong to the *b* tendency. From here the nervous energy seems to pass through other intracortical channels, perhaps back into other regions of the *a* tendency, helping the associated ideas suggested by the picture to realise themselves, until one of them can finally lead to a reaction. In order to explain the total absence of conscious suppression, which happened most frequently with observers C and D who reported instead a rich flow of associated ideas, we need only assume that the cortical substrate of the ideated name radiates its energy diffusely over the entire *b* region which is already in a low degree of excitation. The additional energy thus distributed is, however, not sufficient to raise any part of it above the limen of consciousness. In these instances the suppression, to speak with Langfeld, "can be described solely in terms of cortical set." Before leaving this topic we wish to emphasise again the fact that our discussion of the possible neural mechanism underlying the consciousness of suppression is only a hypothetical reconstruction which cannot in any way affect our experimental results.

The two series of experiments with objects were intended to reveal any psychological differences between the effects of a negative and a positive instruction. Objects were chosen for two reasons. In the first place, they introduced into the situation an element of novelty, which was to counteract the progress of abbreviation that in the case of the pictures had advanced so far as to defeat all attempts at further introspective analysis. In the second place, the visual recognition of objects and their subsequent naming are so frequent among our everyday mental events that they likewise are too much of a shorthand affair to promise results helpful to our purpose. Below are given summaries and examples of introspections on the total period, first with negative and then with positive instruction.

INTROSPECTIONS ON TOTAL PERIOD WITH NEGATIVE INSTRUCTION AND OBJECTS.

Observer A.

During the fore-period strong kinaesthetic strains in the raised arm and tensions in the wrist occur in the earlier experiments, while at the same time the auditory perceptions of the signals are very clear.

Breathing is regularly inhibited and arouses a strong organic complex. The eyes are closed and remain so until the experiment is over.

The tactual perceptions beginning the mid-period are very clear, accompanied sometimes by very faint visual images of the parts touched or of the whole object. Recognition always involves the name of the object, mostly in internal speech. Then follows a very complete attitude of suppression, similar in all respects to that experienced with the pictures. Verbal ideas associated with the object lead finally to articulation.⁸⁰

The reaction is usually accompanied or followed by a strong feeling of relief due to decreased strains of frowning and of holding the breath. Sometimes a slight pleasant feeling of satisfaction takes place, made up of a mental nod and verbal ideas of self-justification.

Observer B.

At "Ready" strains in the forearm arise with incipient kinaesthetic sensations of lowering it. Then an unpleasant disturbance of breathing brings with it a faint nausea. At "Now" the lowering of the arm is at first strongly conscious, later it becomes very automatic and is barely noticed.

The object is grasped tightly, furnishing various cutaneous perceptions of its tactual qualities, such as hard, square, smooth, etc., with verbal ideas. Recognition takes place by definite visual imagery of similar objects, often in vivid colors, and the name occurs in auditory imagery and internal speech, without any tendency to pronounce it. Then a vague verbal idea of the positive part of the instruction flashes through consciousness. The hand moves over the object to isolate the parts, visualizing each until the name of one part occurs, usually as auditory image or internal speech, leading to the reaction. Sometimes the name occurs before the part is touched, or a name is rejected with incipient head-shaking and eye-winking.

After the reaction and the accompanying relief there occur many verbal ideas, usually of wonder whether the reaction will be understood as meant, with a clear visualization of the part named.⁸¹ Sometimes a

⁸⁰ *Cards—Game*, 2.5 sec. "Fore-period was a more passive waiting. 'Ready' was repeated in verbal idea and also as auditory after-image. Then the verbal idea; 'time between Ready and Now is long.' Finally heard 'Now' clearly. The first touch was very clear, but unsatisfactory, too near the palm. Had verbal ideas: 'smoothness, slipperiness.' Then 'cards' came in internal speech with faint visual memory-image of five-spot, followed by the usual attitude of suppression which finally released itself in 'game' with strong clearness of guttural beginning and an accompanying feeling of relief. Then verbal idea: 'that's a natural association.'"

⁸¹ *Electric bulb—Glass*, 2.2 sec. "At 'Ready' incipient sensations of lowering arm and strain sensations in arm, ready to drop at next signal. Very vague idea of what I was to do. Darkness of closed eyelids, no visual imagery. At 'Now' I lowered arm somewhat automatically, expecting something high. Struck something cool, smooth, and nice, then felt sharp point. Named in kinaesthetic-auditory idea and had visual image of similar bulb. Verbal idea 'must not say that.' Felt over object. Then visual image lighted up as thought reflecting light, word 'light' came as auditory-kinaesthetic idea. Feeling of relief as I began to speak. Had been through quite a strain, with verbal idea 'quite a troublesome one.' Then I remembered that I must tell my story, so commenced."

prominent touch-quality is given as a reaction, and once a visual quality.

Observer C.

The signal "Ready" sets up an attitude of expectation, made up of kinaesthetic and cutaneous imagery of grasping and lifting something. With "Now" the instruction flashes into consciousness for a moment, while the arm-movement is very clear.

The first contact arouses sometimes a feeling of surprise or unfamiliarity and a recognition of various touch-qualities. Afterwards the whole object is recognised, especially as soon as a certain part of it is singled out by touch. Its visual image and its name appear, the latter usually in internal speech. It is suppressed by the idea: "must not say it." Further visual and verbal ideas arise.¹¹

One of them leads to the reaction, accompanied by a vague feeling of relief due to the release of the object, with kinaesthetic and tactual sensations, the latter frequently arousing tactual after-images.

Observer D.

In the fore-period the auditory perception of the signals is very distinct. The interval between them is filled by an expectant attitude consisting of muscular strains in lower right arm. The eyes are always closed.

The cutaneous perceptions of the various touch-qualities are sometimes accompanied by a feeling of surprise at the size or shape of the object. The recognition of the whole object involves its visual image and the name in internal speech. But there is never any suppression required, as the object arouses at once further verbal ideas, while the hand is touching the various parts. Sometimes one or another of these verbal ideas is suppressed ideationally, because it had been used too frequently before as a reaction. There is deliberate choice of one of the many verbal ideas in accordance with a self-set task to say the most appropriate word.

The reaction is usually preceded by internal speech and followed by a slight feeling of relief or pleasant satisfaction. Visual memories and verbal comment conclude the after-period.¹²

¹¹ *Knife—Cut*, 1.6 sec. "At 'Ready' had sensations of warmth in palm and a sort of stiffness in arm. At 'Now' I had to think quickly what I should do. Then lowered hand, almost immediately recognised object, with visual and verbal image of knife. Repeated knife in internal speech and had trouble in finding a reaction-word. Then I happened to feel the blades and the word 'cut' appeared, first in internal speech, then said aloud."

¹² *Spool—Sew*, 1.2 sec. "After first signal I heard a slight sound and wondered what object it would be. Feeling of interest. Attitude of expectation in muscular sensations due to position of hand in readiness. Conscious of moving hand down. Immediately at touch the word 'spool' came in internal speech with auditory image, even before I had touched all parts. Then felt middle part to make sure and with it the word 'sew' came automatically. Said it with feeling of surety that it was all right. Verbal idea that reaction-time was shorter than usual."

INTROSPECTIONS ON TOTAL PERIOD WITH POSITIVE INSTRUCTION AND OBJECTS.

Observer A.

The fore-period is quickly becoming automatic; its auditory and kinaesthetic contents are less and less clear, until practically no focus of attention remains, and a conscious blank results. The lowering of the arm is barely conscious.

The first touch-complex, however, is very clear, mixed with kinaesthesia from moving over the object. If any difficulty in recognition occurs, it is marked by frowning and a faint respiratory disturbance. Sometimes the part most touched arouses a very faint visual image. The recognition of the whole object involves in some cases kinaesthetic images of using the object. Then the verbal idea: "oh yes, it's so and so" occurs and leads at once to articulating the name.⁴⁴

The speaking itself is often conscious as an auditory-kinaesthetic complex with a slight feeling of relief or satisfaction. This is followed by more verbal ideas commenting on the nature of the reaction with reference to the instruction. The tactual release of the object leads to a general attitude of relaxation. In the last experiments of this series the tactual perception of the object is followed at once by a slightly pleasant familiarity-feeling and the reaction.

Observer B.

The fore-period has become very automatic, consisting of vague auditory perceptions of the signals and kinaesthesia of position and movement of the arm.

The first contact is very clear and sometimes slightly surprising. It arouses a visual image of the object, usually at first only vague. While moving over the object the parts touched are visualized more clearly, sometimes in vivid and changing colors. Then the name occurs in auditory-kinaesthetic form, but is not said immediately. There intervenes sometimes a vague idea of the new instruction, and sometimes a period of hesitation or uncertainty. After a renewed contact, in order to make sure, the reaction finally takes place.

Frequently it is accompanied by verbal ideas of wonder whether the name was right or whether a better synonym should have been chosen, or similar self-justification and criticism. A feeling of kinaesthetic relief follows, and in a few cases visual memory-images arise.⁴⁵

⁴⁴ *Clamp—Clamp*, 1.6 sec. "Usual vague fore-period. Recognition of object consisted of pleasant feeling of familiarity, very faint visual image of the object, and clearer kinaesthetic imagery of opening clamp and hanging it on nail. Then came the verbal idea 'clamp' leading to articulation. As I said it had verbal idea: 'I ought to have said paper-clamp.' Then feeling of relaxation in hand and all over body, seemed to come after letting go the object."

⁴⁵ *Pencil—Pencil*, 1.9 sec. "Fore-period as usual, very automatic. Then I felt the object carefully, to be able to name the whole object. While touching it had vague visual image of light-grey pencil, which was most distinct where I grasped the object. Then word 'pencil' in auditory-kinaesthetic idea, but did not say it immediately. Was slightly conscious in terms of kinaesthesia in head that I must be sure of object before naming it, therefore hesitated. Had a vague memory of the time when I called a pen a pencil and did not want to make the same mistake. With saying 'pencil' the visual image of it became more distinct."

Observer C.

During the fore-period the instruction is repeated in internal speech, at least in abbreviated form. The arm is lowered automatically at "Now."

Then follow the touch-complexes of the parts successively touched, with recognition of the material, size, etc. As soon as a special part is felt the whole object is recognised and visualised. This leads immediately to the name of the object, at first in internal speech, then as reaction.

The latter is often very automatic and accompanied by visual imagery of similar objects. Tactual after-images occur after releasing the object.⁶⁶

Observer D.

During the fore-period the instruction is repeated at first in internal speech and very completely. Later it becomes more abbreviated and finally is accepted with verbal idea: "yes, sir, I know that," etc. Afterwards it drops out entirely. The arm is lowered almost unconsciously.

The first cutaneous perceptions are very clear and sometimes named in verbal ideas. The recognition of the object occurs with a distinct visual image and the name in internal speech, which, however, is later omitted, so that the reaction occurs immediately. Sometimes wrong recognitions and wrong names occur first, but are inhibited until renewed touch and movements lead to the right name, which is usually due to the contact with a special part of the object.

The reaction is followed by slight feelings of certainty, doubt, etc., and sometimes by new visual and verbal memories.⁶⁷

Before taking up the comparison of the negative with the positive instruction it is necessary to consider the changes introduced into consciousness by the use of objects instead of pictures. The only important difference seems to take place in the stage of recognition. The pictures used in our experiments are so small that the eye can take in the whole object at a single glance and recognise it immediately. The objects, however, are of different sizes, so that one grasp by the hand reveals as a rule only a part of the object. In the course of making several successive grasps, or of moving the fingers over the object, certain parts are sometimes recognised

⁶⁶ *Rubber-stamp—Stamp*, 3.3 sec. "After 'Ready' repeated directions in internal speech. First contact was roughness of small disc. Feeling of unfamiliarity. Ran fingers over it until I came to handle. Recognised it at once, visual image of stamp with rubber-handle and nickel-plated rubber-holder. Then word 'stamp' was spoken automatically. Next I had visual image of stamped paper and several tactual after-images."

⁶⁷ *Nail-file—File*, 2.3 sec. "Fore-period as usual. Cutaneous perceptions of cold metal and pointed rough end. Grasped handle first and was uncertain until I touched file-part. Visual image of silver nail-file with steel end and dull point. Then a clear image of some design on the handle. Said 'file' automatically, without internal speech. Had feeling of certainty that I was correct."

and named independently in verbal ideas, before the whole object as such is known, as in the case of the handle of the screw-driver. Frequently the recognition of the object depends upon contact with a special part; thus, several observers recognised the electric bulb as soon as they touched its sharp point. In most cases the first few contacts furnish only isolated perceptions of touch-qualities, of form, size, weight, material, etc. The final recognition of the whole object is usually made up, asode from the cutaneous complexes, of clear visual images, often in vivid colors, of similar objects (except with A, who is a poor visualizer), of the name of the object in verbal idea or internal speech, and of a more or less pleasant feeling of familiarity. As in the case of the pictures the recognition is followed by the stages of suppression and of search (except with D, for the same reason as in the experiments with pictures), which in their mental structure are like the corresponding stages of the earlier experiments. There is likewise no important change in the fore and after period. It is evident, then, that the experiments with objects and negative instruction confirm in every way the results obtained with the visual stimuli.

In one respect this similarity is somewhat surprising. We must remember that the instruction calls for the first word suggested by the object. One should expect, then, that the very touch-perceptions would lead to immediate reactions. Instead, the observers in every case wait for the recognition of the whole object, which is not required or even suggested by the instruction, and which besides is unnecessary, as unrecognised pictures or objects ordinarily may lead to reactions. There seem to be two possible explanations. On the one hand, we may refer to the racial predisposition or instinctive *Einstellung* to cognise everything,⁶⁸ which may make itself more strongly felt in unusual situations where the sense of sight is excluded. If such a general racial predisposition exists, we must assume it also to function in the experiments with the pictures. Indeed, here it may superpose itself upon the particular tendency to name the pictures, and may thus give this a tendency the initial slight advantage which our introspections lead us to attribute to it. On the other hand, we have reason to believe that the *a* tendency, to name the first word suggested by the object, is far less strong than the *b* tendency, except with regard to the forbidden name which is set in neural readiness by both of them together, although

⁶⁸ Titchener, *Lectures on Thought-Processes*, pp. 124 and 250.

perhaps more by the *b* tendency than by the *a* tendency. As long, therefore, as the tendency to suppress is stronger than any other tendency, the former must necessarily bring the forbidden name to consciousness. That is to say, the mental processes constituting the attitude or the idea of suppression, and meaning: "must not say it," presuppose the conscious existence of the experience to be suppressed, or in everyday language: we must know what to suppress, and we can neither know nor suppress it if it is not in consciousness. It may be true, as Freud's theory seems to maintain, that both act and object of suppression under certain abnormal conditions become unconscious, that is, function neurally only; but the present experiments furnish no evidence for this position, perhaps because the required abnormal conditions were not realised; neither did the writer, in his introspective analysis of the 'concealed complex,' find any support for it.⁵⁹ A comparison of the consciousness under negative instruction with the consciousness of the hidden complex is reserved for a future occasion. In the meanwhile the writer, who is at present unable to continue the study of these topics, may be permitted to suggest here the problems of analysing the consciousness of negative judgments and negative suggestions.

A glance at the introspections with positive instruction reveals at once the much greater poverty in mental contents and much quicker automatization of the whole consciousness. In the fore-period the new instruction is repeated a few times in the earlier experiments by C and D, never by A and B, although with B a verbal memory of it occurs occasionally in the mid-period, when recognition is difficult. In the case of A, B, and D, such difficulties are not rare and lead to an attitude of exaggerated caution in reacting, which shows itself in longer reaction-times. This result seems to be purely accidental, and is due to partly or totally unsuccessful recognitions. With C tactual recognition seems to be rather easy and quick, although even here a few difficult cases increase the range and mean variation of the reaction-times, while their average length, which otherwise would have been less, is thus made equal to that of the previous series. Aside from the accidental attitude of caution the mid-periods differ from those with negative instruction in the obvious absence of the

⁵⁹ A preliminary Introspective Study of the Association-Reaction Consciousness. *Am. Jour. Psychol.*, XXI, 1910, 597-602.

stages of suppression and hesitation, while the after-periods of the two series are very much alike.

Following out our previous hypothesis, we must now assume that the positive instruction sets up a determining tendency to say the name of the object. Langfeld seems to think that it also sets up determining tendencies not to say anything else. He writes: "in all positive attitudes one can say that there is also a negative quality, inasmuch as the way is blocked for all associations not included in the instructions." Now the term 'negative quality' in this connection is ambiguous; and the statement seems to us to be based on logical argument rather than on psychological evidence. Logically, to be sure, any x implies a not- x ; but the logical implication is valid whether it is ever experienced in an individual consciousness or not. As soon, however, as it is thus experienced, x and not- x become at once psychological existences or mental processes. But the reverse need not necessarily be true, that is, the mere experience of x need not involve either the presence or the suppression, even the subconscious suppression, of the not- x . Our new instruction: "do not react with anything except the name of the object" is as favorable to the formation of such a tendency to suppress other ideas as it can be made in combination with a positive instruction. Nevertheless our introspections do not furnish the slightest evidence of a conscious or unconscious blocking of undesired associations. They lead us, therefore, to the conclusion that the only difference in consciousness under a positive and under a negative instruction is the absence or presence of the stage of suppression in either of its two forms. They also seem to support the view that a simple positive instruction sets up only one determining tendency, in accordance with which certain mental processes are neurally prepared for easier and quicker entry into consciousness as soon as the proper stimulus occurs; while a negative instruction sets up at least two determining tendencies, which either bring about a more or less conscious conflict of two mutually exclusive motor reactions, as in the attitudinal form of suppression, or prevent their ideational representations from issuing in motor discharge, and thus allow another neurally prepared process to lead to a reaction, as occurs in the ideational form of suppression.

In conclusion the writer regrets that lack of time and library facilities prevent his discussion of the recent literature pertaining to this subject.

THE THEORY AND LIMITATIONS OF INTROSPECTION

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I suppose that no reputable scientist would venture to publish any considerable alleged discovery in the physical sciences without a careful investigation of his instruments under the precise conditions under which they were used. His statement of instrumental variability, latency, and constant errors would constitute data for a scientific evaluation both of his technique and of his experimental results.

In some directions at least, psychology has been as conscientious in matters of technique as any of the biological sciences. In the investigations of sense perception, for example, of memory, reaction, and the Weber-Fechner law, it has criticized its technique and calibrated its instruments, not infrequently with tedious attention to details.

In view of such evidences of scientific conscience will it not seem all the more surprising to the future historian of science that psychology still uses its most fundamental instrument with a jealous, insistent confidence in its universal applicability and adequacy which approaches dogmatism?

To be sure psychology has not been without its chastening experiences. Theoretical discussions are not wanting from Comte to Möbius which point out the fallaciousness of all introspection and the consequent "hopelessness of all empirical psychology." In a more hopeful, and probably also in a more scientific spirit, specific errors and sources of error have been pointed out, and concrete rules for introspection have been formulated. But, in by far the largest number of introspective investigations, all account of the theoretical applicability and consequent limitations of introspection with respect to the problem at hand is conspicuously lacking. The most notable recent exception to this rule with which I am acquainted, is the recent *Ergänzungsband* of the *Zeitschrift* by Müller.¹ In contrast to this model of critical introspective technique, some of the studies in which introspection has been

¹ *Zeitschrift für Psychologie. Ergänzungsband V, 1911.*

pushed farthest seem to approach the limit of uncritical procedure.

Undoubtedly, a complete systematic investigation of the relative reliability of introspection in the various lines of psychological investigation would be difficult. Perhaps it would be impossible. In general, I suppose that the reliability of any one method must be expressed in terms of another. Mere variability is not conclusive unless we have some means of proving that the phenomena themselves are really invariants. Introspection has the peculiar fortune or misfortune that the precise phenomena which it mediates are given in no other way.

Even if a test of relative reliability were possible, it might well be questioned what is the use of trying to measure the value of the only available method. If we are utterly dependent on it why not simply accept it? The objection is not entirely imaginary. It represents a traditional attitude.

The question of possibility can only be answered by the attempt. If the thing is worth while let us go as far as we can.

To the question whether it is worth while my answer seems obvious enough. If there is any way of estimating the probable error of introspection under various conditions, or any way of discovering its theoretical limitations, two real scientific advances will have been made; we shall have some measure of the relative certainty and finality of alleged introspective facts, and we shall have the stimulus that comes with a consciousness of our limitations.

The occasional fallibility of introspection is no new heresy. Concrete contradictions in the introspections of different observers, the limitations of individualism and the impossibility of subjecting the facts of introspection to mathematical formulation in any other way, led to the adoption of experimental conditions. This was the guiding principle of the "new psychology." Psychology has indeed changed both in content and in method since the days of its complete bondage to philosophy. I believe it still promises growth.

Gradually increasing knowledge of the anatomy and physiology of the nervous system, and of the interdependence between neuroses and psychoses, forced psychology into a quasi-alliance with physiology. Up to the present time however, it is conspicuous that the two books—physiology of the nervous system on the one hand, and analytical psychology on the other—have but scant relationship. The splendid illustrations of histological preparations to which the novice

must still accustom himself in psychological text-books function chiefly by their impressiveness. Nervous anatomy and physiology have raised more questions in psychology than they have answered. But persistent inquiry into the physiological conditions of consciousness is conspicuously lacking. On the basis of a postulated parallelism, psychologists have chiefly been content to state the facts in both series, confuse the terminology a little, and leave the detailed correlation to the uncontrolled imagination.

Recent rapid growth of exact information in allied fields of medicine and general physiology finds even less place for itself in orthodox introspective psychology. Though for some of us, it stimulates a persistent belief in the possibility of coördination and unification.

But it is the lack of unity and scientific coherence in the stuff of contemporary psychology, the growing gaps between the different lines of investigation, and the inhospitality of introspective psychology to non-introspective facts however closely related, that raise the methodological question. They emphasize the need of every growing science that, from time to time, it give its postulates and its methods careful scrutiny. If introspective facts are the only mental reality, then our course is clear and relatively simple. If, on the other hand, there are any other real indicators of the mental life, then, in my opinion, we not only miss our opportunities when we refuse to use them, but we make ourselves ridiculous by our inability to emancipate ourselves from philosophical tradition.

After all then, it is the professed dogmatic intolerance of introspective psychology that forced me to methodological discussion. In spite of many vigorous protests, it still seems orthodox to regard introspection as the only true psychological method, equally adequate for every psychological inquiry. In spite of the long list of those who have contended for the possibility of unconscious mental reality, our dominating tradition is the dualistic dogma that that alone is mental reality which is given in introspection. All other facts, however closely related, are physical or physiological. Psychologists as far removed from each other as Lipps and Titchener agree in the fundamental assumption that non-introspective facts are non-psychological. Even when as in some recent text-books behavior is recognized and even emphasized in psychological method, its function still seems to be to indicate the existence of introspectively discoverable facts.

In this view of the case, the direct experimental formulation of a problem of mental organization, like mental fatigue,

as a problem of organic life is a methodological absurdity. The only legitimated functions of experiment are either to provide suitable conditions for introspection, or objectively to lead to the presumption that adequate introspection of the subject would reveal something. Failure to introspect condemns an investigation to the outer darkness of physiology. Facts of nervous action may be interesting or even suggestive but "psychology better take them from the physiologist." In public conference not long ago it was seriously questioned whether titles in nervous anatomy and physiology couldn't well be omitted from the Psychological Index.

Against this dogmatic dualism of science it is the business of this paper to make earnest protest. One may have patience with parallelism as a working hypothesis even though one believes it to be both useless and misleading. But when the working hypothesis disguise really covers a dogmatic ontology, then it ceases to be scientific or even honest.

It may be that after all it were better to surrender the name psychology to those who believe that it applies only to a description of the findings of introspective consciousness. If so then let us candidly confess allegiance to another science—a science of the conditions of human experience, conduct and personality. It will be a true science in that it will investigate the totality of the conditions of the phenomena with which it deals. Rather than haggle about its source, it will welcome every real indicator. Every fact that may throw light on conduct, experience, or personality whether from pathology, neurology, introspection, or the behavior of animals will find itself at home, not merely a stranger's welcome.

Personally I believe that the proper name for such a science is psychology, the science of the highest principle of organization of human life. A name which only comparatively recently in the history of science has been appropriated for a small group of important relevant facts which sadly needed straightening out and systematizing, but which of themselves neither constituted a science, nor found any need of a soul. It is difficult to see why they insist on the name.

It is my belief that an adequate critique of the theory of introspection will show that non-introspective evidence is not only legitimate in certain directions; but that, if obvious limitations of introspection are to be transcended, it is a necessary complement to introspection. It will be a later task to show that such relevant evidence exists in connection with mental work and mental fatigue.

The Problems of Introspection

Notwithstanding the arraignment of Comte, there is no serious inclination among contemporary scientists, as far as I know, to deny the possibility of introspection. Apparently each of us is aware in a very direct and convincing way of sequences and coexistences of mental facts, and of certain differences and similarities between them. Probably most psychologists would go further. With the aid of experiment, the rise and development of a conscious fact may be said to be an *observable* experience. It is just as real and just as truly observable as the development of an embryo. Observation interferes with one no more than it does with the other.

Furthermore there is no real difference among psychologists concerning the importance of introspection. The reality of introspection and its "radical" importance in any science of human experience are indisputable.

But introspection is not only a method of psychological investigation, it is also a mental fact, and as such it must be capable of psychological analysis and investigation.

Quite apart, then, from epistemological questions, which can only confuse the issue, the fundamental psychological problem with respect to introspection is to understand it as a mental fact.

The second problem is; how far into the nature of the various other mental processes can such an instrument be expected to penetrate?

A third problem will as a matter of fact eventually grow out of our answer to the second, viz., the old problem of supplementing introspective experience where its data are not unimpeachable, or where it raises questions that it cannot directly answer.

Theory of Introspection

There seem to be two main types of tradition with respect to introspection. The oldest and most widely held is dogmatic introspective realism. Beginning early in ancient philosophy it served as postulate equally for the most various pre-Kantian philosophies. The Cartesians, the English Empiricists and the Continental Sensationalists, however they differed with respect to the origin and validity of our knowledge of an external world, and however divergent their deductions, all agreed that knowledge of our own mental life was immediate and adequate. To think and to be aware that we think was one and the same process. The existence

of any real mental fact which was not evident in self-consciousness was consequently inconceivable. If, as thinking substance, we do not know how we move our arm, it follows self-evidently for Geulincx that some other being must do it for us. The act is none of ours.

Across the channel the principle led to the denial of innate principles. Its logical conclusion was the denial of soul itself. We never come upon it in our most exhaustive introspections.

Only when the problem of the gap between the knower and the known became an inner problem of the monad do we find a toleration of non-introspectable mental facts. For the monad, whose being consists in perception, the failure to realize that it is perceiving must be explained by some difference in its perceptions. But it was in conjunction with this admission of imperceptible perceptions that introspective realism reached its highest pre-Kantian formulation. For Leibnitz all reality is fundamentally of the same kind that is given to us directly in introspection.

First in Tetens and Kant do we find a clear consciousness that the inner perception like the outer gives us only phenomena. But introspective realism persisted in post-Kantian philosophy. And in spite of a habit of speech by which most of us as a matter of course speak of mental phenomena,² introspective realism is still dominant in modern psychology.

Now for the thoroughgoing introspective realists, I suppose that there is no introspective problem at all. They are immediately aware each of his own mental world. What each knows of himself is ultimate reality, since in his particular case, knowing and known are identical and identity leaves no room for discrepancies. To be sure the inter-subjective discrepancies in alleged introspective facts, the gradual growth of an introspective technique, and the obvious epistemological difficulties in substituting feeling or willing for knowing in the identical proposition, might well arouse the realist's suspicions. But it is simpler to regard the discrepancies as accidents, or to limit mentality to the intellect. Unfortunately realism and phenomenism seem to be subject to the physiological "all or none law."

But it was in the critical discussions of introspective phenomenism that there arose a new and insistent problem, the psychological problem of the inner sense, viz., How does mind perceive itself?

The various physical stimuli and the peculiarities of the

² BRENTANO, *Psychologie* p. 10 fol. defends the use of the terms mental phenomena entirely without metaphysical implications.

different sense organs seemed to account for the qualitative differences in sensation. The elaboration of the sense material into experience depended on central conditions, sense forms, the categories, and in general the organized residua of past experience.

For the inner sense on the contrary there was no obvious sense mechanism. No inner eye explored the inner horizon. No inner touch brought them in contact with themselves.

Within the Aristotelian tradition that sensation is a being moved, a being impressed, a *vis passiva*, the introspective problem naturally took the form: How can mind impress itself? How can it be at once mover and moved? impressor and impressed, active and passive? The simplest answer was negative. But to say it can't is to ignore the facts. We can and do introspect.

One may point out in passing, that an inner sensory mechanism would not be very valuable if we had it. If the miracle of transforming physical energy into consciousness has once taken place, there would be no function for an inner sense mechanism. There would be nothing to transform. It would be of no special service to the physiologist since his problems need finer tools than any organs we would likely be endowed with. In practical life on the other hand, it would be a distinct disadvantage. Additional facilities in introspection would doubtless as Kant suggests turn humanity into a race of hypochondriacs. There are enough tendencies in that direction as it is.

I suppose it is to Leibnitz on the Continent and to Berkeley in England that we really owe the modern protest against the passivity of perception. The monads have no windows. Visual facts are only signs for the perception of space. But in our more immediate psychological tradition, it was the Herbartian doctrine of apperception which, in spite of its unsatisfactory assumption of energizing ideas, first put the theory of perception on a permanent basis.

It is now pretty generally accepted that, however we may view the abstract sensation, every complete process of perception is an active process. Perception always involves factors from past experience. Systems of organized residua, the apperceptive masses of Herbartian terminology, are the conspicuous conditions of a unified experience. They emphasize, modify, complete, distort and select from possible sense material.

Every adequate sense stimulation arouses these residua of past experience. It fuses with some into the percept.

It associates itself with others in various systematic ways so that every percept comes to consciousness in a complex setting—as a member of temporal, spatial, causal, and meaning systems. If the stimulation occurs in sleep and arouses no residua of past experience there is no consciousness at all.

Now while the inner sense lacks every vestige of a sense organ, the apperceptive elaboration represents a side of the perceptive process that is available for the inner sense as well as for the outer. In introspection to be sure the apperceptive systems are peculiarly selected. But if the proper apperceptive systems are granted, it is obviously as easy to integrate a fact of consciousness with other similar facts into an inner experience as to integrate it with motor and sensory factors into spatial position and causal relationships. The differentia of a physical fact is its objectification in a world of extended things. This has found various expression. As the Cartesians put it, the essence of body is extension. As Kant expressed it, the form of the external sense is space. The differentia of the facts of psychology is that they are regarded as “having place in or being part of some one’s consciousness or experience.”^a

That is they differ from the physical facts entirely in their noetic setting, not in the stuff.

That this is a valid account of the process of introspection may appear from a description of a concrete instance. If I have a given percept say a vase, perception itself places it directly in spatial relationships with an external world of things. I perceive it at such a distance, of such a shape, and size, beautiful or ugly. More remotely it is known as new or familiar, as having a certain function, and value, as having certain physical and chemical properties, etc. When these various classifications are complete I shall have apprehended the vase in all its objective relationships as a part of my objectified experience of a world of things. But any part of the above processes may also be the object of introspection. The process I would apprehend introspectively doesn’t change; that is, under the simplest ideal conditions it doesn’t. What do change are the apperceiving noetic systems. They no longer relate to position, size, use, and history, but to the inner complication and sequence of experience. Since the object in the two series may remain identical the difference between psychology and physics is not a different stuff, but a different group of relationships.

^a WARD, *Encyclopaedia Britannica*, Ed. 11.

To be sure the stuff may also change but differences of stuff are not necessary.

Brentano insists that the object of psychology is presentation as process, while the object of physics is the presentation result. If we attempt to reduce this difference to psychological terms it seems doubtful if we can distinguish directly between the idea as process and the idea as result in any other way than the one I have pointed out.

In an analogous way observation of the same identical physical fact, for example the fall of an apple, yields data for the various scientific disciplines according to the various systematic groupings of experience with which it happens to integrate. If it integrates with any of the systematic groupings of experience itself, it yields data for a science of experience as such.

Use of the term self-perception is misleading if it suggests any necessarily peculiar object of regard that may be perceived only by an internal sense, or if it suggests a division of the self into observed and observing, different from that which occurs in every moment of attentive observation.

Neither the stuff of introspection nor its methods are unique. The differentia of a science of experience is that as a group of organized experience the lines of similarity and difference along which the organization is effected involve an abstraction from the spatial attributes of experience.

An experimental test of the validity of this account of introspection seems to be impossible. If the theory is true every attempted experimental test of it would involve pre-determined apperceptive factors, which would approximately correspond with the sum total of the experimenter's past experience and philosophic prejudices concerning the matter. As an experiment in introspection it would prove nothing except the experimenter's attitude to the problem.

If this psychological account is true, however, the history of introspective psychology should furnish evidence at every step that the introspective process was determined by the available apperceptive systems. It should show this both in the development of the individual psychologist and in the development of introspective schools or fashions.

The training of an introspective psychologist seems to be no less exacting than the training of an observer in natural history. Neither is born ready-made. Both require a certain amount of practice. Both observe better the more complete

their information is about what they are to observe. The fundamental rules to avoid prejudice, inference, and the infusion of affection are alike for both. Even though his material is supposed to be given to him directly, a beginner's observations in psychology are as useless as in histology.

He observes what he is acquainted with or thinks that he is acquainted with. Most of it is trivial. The really important matters he overlooks until his attention is called to them; i.e., until he has developed adequate apperceptive systems.

Even the trained introspectionists are liable to error. Few psychologists now-a-days are content with analyses "am grünen Tisch." Lipp's "pure" psychological experiments are commonly only the preliminaries for carefully planned experimental modifications of the determinable conditions. Every trained psychologist is aware of the insidious outcrops of expectation and interest, of the effects of suggestion and leading question, of the tendency to find what the instructor or the theory demands. At least in our pupils we are aware of all these things. The history of psychology shows that they are universal.

Just now we are struggling with an illuminating question in the problem of imageless thought. More than once it has been pointed out that the individual's answer to the question depends largely on the school in which he was trained; i.e., on the categories and schemes with which he happens to be equipped. Imageless thinkers, on the other hand, find considerable difficulty in naming their categories and in describing their experiences in positive terms without reference to sense imagery. If they really do find imageless experience, most of us clearly lack the appropriate apperceptive systems. At the heart of the matter I believe the real problem is not whether a given observer always finds sensory factors in the analysis of all his mental experience, but how any observer with the usual training could avoid finding them, whether they were necessary parts of that experience or not.

The facts can doubtless be seen with less emotional disturbance in temporal perspective. But enough, the history of psychology shows exactly the same dependence of observation on its apperceptive systems that is seen in the natural sciences or in practical affairs. I fear I have been guilty of proving the obvious. But if so there is all the less reason for us to hesitate in the conclusions.

The Limitations of Introspection

An adequate theory of introspection should furnish a unifying principle of those empirical rules by which the more conscientious introspectionists have governed their practice. It should also indicate the origin of those disturbing individual differences in introspection that more than any other one factor prevent us from speaking of a science of introspective psychology.

Both of these deductions from our theory of introspection are eminently practicable if this were the proper occasion for them. What is more to our present purpose, an adequate theory of introspection should also enable us to estimate the kind and amount of information that may be expected from it. This was our second problem. Let me put the main issues concisely in the form of hypothetical questions.

If for the sake of argument consciousness should be supposed to be a kind of organization of what is otherwise non-conscious except in its potentialities, could introspection as we have learned to know it ever give us directly either the unorganized elements or the process of their organization? Would not inquiry concerning these facts, however, be both a legitimate and a necessary part of any science of such organic life?

If mental life should for the sake of argument be supposed to be extremely complex, so that each moment of consciousness involved n factors in various grades of clearness, would any more of the total complex be directly observable by introspection than could in turn be cleared in consciousness through the arousal of appropriate apperceptive systems for the successive integration of the complex, part by part?

Conversely, if introspection at any moment found only one, or relatively few, or only one kind of elements in consciousness, would that constitute evidence that the actual facts of mental life were simple, or might it not be that internal vision was limited by the limitations of our instrument?

If consciousness itself, for the sake of argument, should be regarded as a process of integration, could the process itself ever get integrated in terms of its resultants? Would not an introspective psychology forever be doomed to blindness with respect to the dynamic reality?

Perhaps all of the hypothetical antecedents are contrary to fact. That is beside the point. They are all possible as far at least as any legitimate scientific presupposition is concerned. No scientific method has the right to start arbitrarily with

the assumption that they are all wrong. Their truth or falsehood must be regarded as a matter of fact. Our conviction should not be based on philosophical prejudice but on whatever evidence we can obtain.

Some of the limitations of introspection as a tool for investigating the mental life are finding ample confirmation in the disclosures of those apparently large and relatively important fields of the "sub-conscious." Many of us dislike the term with cause. It seems to stand for a mass of unscientific speculation. At best it says too much. Personally, I prefer the word "uncleared"⁴—which merely states the facts and leaves the implications for science and not for speculation. "Uncleared" mental facts may be conscious or sub-conscious or unconscious. Their generic characteristic is that in some way or other they fail of having been taken up in the introspective integration. Some of the facts that are uncleared in one moment of consciousness become cleared in the next. Some of them have waited long for adequate integrative systems. Some are perhaps by their very nature eternally condemned to obscurity. The dependence of the clearing process on the available integrative systems emphasizes the value of direct experiment, of the unusual, the exaggerated, and the striking. Even the purely physiological and the pathological may indicate new lines of cleavage.

Even under the most favorable circumstances it would seem to be theoretically impossible for introspection to disclose the elements of consciousness. The current doctrine of sensation might seem to disprove this. But sensations as introspective psychical elements are rank pretenders. A simple sensation is of course utterly undiscoverable by any process of introspection. Certain abstract qualities of consciousness, as we know it in introspection, have in the course of scientific progress become hypostatized and unified as sensations. But when it is held that the attributes of sensation include quality, duration, extensity, and intensity; and I would add consciousness of their reality as part of personal experience, with an indefinite number of relationships to the rest of experience—it seems absurd to regard the observable sensations as elemental.

On the contrary, the real elements, in the sense of the stuff of which consciousness is composed, must forever be in-

⁴ An Experimental Study of Visual Fixation, Chaps. II and III, *Psy. Rev. Monographs*, No. 35.

accessible to introspection, since in introspection we can only find completed consciousness.

This may not seem very serious, but it forces the question: If we would discover the stuff out of which consciousness is made, where will we seek it? Perhaps we may come closer to it in the physico-chemical constructs of biology than in the sensations of psychology. At least the former have as much claim to our attention as any introspective fact.

Furthermore, introspection seems incapable of disclosing the apperceptive masses on which any given moment of awareness depends. One or two aspects it may pick up and bring to the focus of consciousness. A few may in turn be apperceived, but the great bulk must remain forever uncleared.

We can never hope that the conditions of consciousness will be disclosed in consciousness. C. in moment 2 may discover some of the conditions of C. in moment 1. But that will be by retrospective analysis and inference and not because C. in any moment perceived its conditions.

Introspection has never been able to fill out the causal relations of any fact of consciousness, or to complete a statement of its conditions. The rise of an idea is always something of a miracle. After it has come we can find some premonitions of it in antecedent consciousness. But the same discoverable antecedents may to-morrow give rise to a totally different effect. How any particular concept was synthesized we cannot tell by introspection. We have never discovered the welding process. We have never traced the steps of manufacture. The feeling of inspiration that commonly accompanies ideas of sufficient impressiveness seems to be a phenomenal correlate of the hiatus of introspection.

Finally the psychical dispositions, psychophysical or physiological residua, engrams, or whatever we may for convenience call them, are never directly accessible. Only by construction do we know any thing at all of residua. Yet even the most ardent introspectionist would hardly deny that our knowledge of memory and the rate of forgetting belongs to psychology.

But perhaps it will be claimed that all the inaccessible depths of the uncleared are of the same nature as the accessible, just deeper water that our sounding lines will not quite reach. I believe that the evidence is against it: The subconscious, the elements of consciousness, the processes of their integration, and the residua of past experience differ from consciousness in one very significant fact that they are

not describable in terms of introspective categories, except negatively. As far as I can see there is no reason to suppose that a scientific construct in psychology will be any more like the facts of simple observation than the scientific constructs in physics are like the simple facts of observation. I can see no reason for believing that introspection guarantees any closer approximation to the concept that embodies the summary of all the available indicators than does sense perception.

Finally, self observation, as a means of analysis of consciousness, or as the basis of a description of the complex whole, regularly and inevitably contaminates the results. More than once in the history of chemistry, supposed traces of various elements have been reduced to ingredients of the vessels used. Modern chemistry makes an entirely justifiable demand that every analysis must rigidly exclude the possibility of introducing its findings in its technique.

Now unfortunately in introspection the instrument may contain everything that can appear in the analysis. Nay more, it must contain everything that the analysis can discover. If a factor is expected, it is ipso facto in consciousness. No amount of scientific caution can separate entirely the observed fact from its apperceptive masses. Even if one conjectures that a factor will not appear, its subsequent appearance will not be entirely free from the possibility of error. To have been considered at all is to have been in consciousness and consequently easily revivable. The difficulty is inherent in the psychology of observation. Good observers must be trained—trained to look for certain specific things. Psychological observation offers no exception to the rule. No psychological scheme has been too absurd to be supported by introspection. It shows fashions like hysteria and the delusions of the insane. Even the fundamental categories of consciousness change with the years, while new and previously totally unsuspected facts may be readily introspected as soon as there is theoretical ground for belief that they exist.

On these considerations the methodological dogma that all mental reality is subjectively observable and conversely that the subjectively observable alone is mental reality seems to me utterly unjustifiable. Moreover, analogy of the successful empirical sciences is opposed to it.

To be sure, as Titchener insists, every natural science picks out some specific group of phenomena for investigation. Let us take sound for example. Within the limits of direct obser-

vation physics describes the phenomena of sound. But what would be our science of sound if we expurgated everything that wasn't directly an auditory experience? Sound waves for example are never directly observable. But how absurd it would be to insist that they are metaphysical or non-physical because they are not a direct part of that group of phenomena with which acoustics deals. To be sure we have no sense organs fitted for their perception. But experiments are readily devised to demonstrate their existence. The experiment doesn't make them audible otherwise than as sound. It doesn't even make them feelable or visible. It adjusts its technique so that visible and feelable facts shall become reliable indicators not only of the existence but of the character of the reality that we can never hope to know directly except as sound. It is a wonder the metaphysician never hit on the expedient of a visual-auditory parallelism. He probably would if physics had allowed itself to be invaded by the high a priori road as psychology has been.

It may be objected that the only reality in acoustics is sound and that the rhythmic displacement of visible particles isn't sound at all. The only possible answer is affirmative. But we must go one step farther and assert that in the scientific effort to apprehend reality all real indicators are significant. The direct sensory facts have no peculiar claim even in physics. Is the mechanism of the inner sense so much more reliable and adequate than that of the outer senses that it alone gives us things as they are, or spares us the necessity of scientific construction?

If in practice or in fatigue experiments, certain mental processes are found to be correlated, I believe that is as valid an indication of mental fact as the most elaborately controlled introspection. If there is experimental evidence that certain mental capacities suffer measurable objective change, I believe that is just as truly a psychological fact as anything that is discovered by introspection. Indeed, in this case at least, the objective method will be far more reliable.

The danger of this position is that it seems to open the door for that kind of metaphysical constructions that psychology has been centuries in freeing itself from. The danger is a real one, but it is not peculiar to psychology. In this direction at least, I believe it is our duty to make the break with philosophy clean cut and complete. Psychology as special science has no right to metaphysical constructs. Her constructs must be her own. They must be scientific constructs in the narrowest sense of the word. And it is the

manifest duty of those who are interested in psychology as a special science to scrutinize every hypothesis that enters the fabric of their thinking and criticize them by scientific canons.

In view of all the evidence I believe that introspection is only one of the indicators of mental reality. It is a real and important indicator of peculiar value in special fields but it is only one of many. Equally real I believe is every pathological or neurological fact, every result of practice, training or fatigue that throws any light on mental capacity, mental organization, or mental defects.

PSYCHOPATHOLOGY AND NEUROPATHOLOGY: THE PROBLEMS OF TEACHING AND RESEARCH CONTRASTED¹

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The ideas that I wish to bring to this symposium are few, and I hope not too unorthodox. How shall research psychology and research medicine come together, on what ground, and to what ends? I wish (1) to insist strongly on the unique value of the pathological method, not merely for the diagnostic and therapeutic purposes of medicine, but for biology as a whole and for the most vital of biological sciences, psychology. I wish (2) to point out how pernicious in research may be the dogmatic insistence on the doctrine of psychophysical parallelism in medical or premedical courses in psychology, pernicious because it inhibits the free interchange of structural and functional concepts and the passage to and fro of workers in the several sciences. I wish (3) to show that psychology and physiology have more in common than either has with such structural sciences as anatomy and histology, and that the main common element of both mental and cerebral processes is the time element as against the space-element of the structural sciences. On this ground (4) I conceive that the mind twist and brain spot hypotheses for the explanation of certain forms of mental disease are entirely consistent with each other, since from a different angle each is dealing with the same facts. (5) Above all let us not divide up the tasks of research as we divide up the tasks of teaching, since research, looking to the future, defies the compartments of the past.

"It always leads to a better understanding of a thing's significance," wrote W. James, "to consider its exaggerations and perversions, its equivalents and substitutes and nearest relatives elsewhere. * * * Insane conditions have this advantage, that they isolate special factors of the mental life.

¹ Read by invitation in a symposium at the meeting of the American Psychological Association, December 28, 1911, at the Government Hospital for the Insane, Washington, D. C.

* * * The study of hallucinations has in this way been for psychologists the key to their comprehension of normal sensation, that of illusions has been the key to the right comprehension of perception. Morbid impulses and imperative conceptions, 'fixed ideas,' so called, have thrown a flood of light on the psychology of the normal will; and obsessions and delusions have performed the same service for that of the normal faculty of belief."

I here quote from the *Varieties of Religious Experience*. It is perhaps in such complex fields as this that the natural analyses effected by disease possess their widest scope. Even where more artificial analysis is possible, the pathological method has often yielded the most fortunate short cuts. One of the richest generalizations of biology at large (the dictum *omnis cellula e cellula*) could hardly have been achieved by a commission of biologists empowered to study normal cells, and only normal cells, without decades of labor: the utilization of abnormal material gave a long range induction almost at once. The pathological foundation of the doctrine of evolution is obvious to any one who considers what survival of the fit means in terms of the unfit. The doctrines of immunity derive an indispensable constituent from the law of regeneration in surplus which Weigert observed in his studies of interstitial tissue. The bacteriology of disease has afforded some of the shortest cuts and the longest new ranges of thought of which we know or can conceive. The more complex the subject of our study, the less progress do we make by confining our attention to the normal presentment of that object. Normality is baffling, like the Roc's egg to the climbing Sinbad. A niche, a wedge, fragmentation, dissection, division of intellectual labor, all the screening and sifting which lie at the basis of experimentation, these characterize the method of pathology, which pays small heed to the pedagogical divisions of any former stage of a given science. The research pathologist follows the trail of the concrete through whatever ranges of the abstract become necessary, and through no others.

It is here that the school divisions of psychology and brain physiology, of psychology and brain anatomy, of brain physiology and brain anatomy, of anthropology and social statistics, of sociology and criminal anthropology, and a host of other abstract school divisions have entered to divert the research worker from his duty to the concrete complexity.

Particularly dangerous I find to be certain school tendencies born of the doctrine of psychophysical parallelism.

The teacher of psychology desires to keep *mind* logically distinct from *body*: the teacher of physiology disclaims expert knowledge of psychology: the teacher of brain anatomy almost skilfully avoids giving his point of view about anything remotely functional.

The student grows to a feeling that the confines and septa of pedagogy are the confines and septa of research. For the development of psychopathology and of neuropathology, which I consider to be school divisions of knowledge of no ultimate logical importance, no other single doctrine has, to my thinking, been so pernicious as the doctrine which proposes to separate mind and body before we know much about either.

Most of us remember James' neat critique of the "*Ohne Phosphor, kein Gedanke*" psychology. "The phosphorus-philosophers," said James, "have often compared thought to a secretion. 'The brain secretes thought, as the kidneys urine, or as the liver secretes bile,' are phrases which one sometimes hears. The lame analogy," continues James, "need hardly be pointed out. * * * We know of nothing connected with liver and kidney activity which can be in the remotest degree compared with the stream of thought that accompanies the brain's material secretions."

I remember smiling as a college student at the folly of these phosphorus men, thus dispatched at a blow. The fact is, a friend explained to me, *Ohne Gedanke kein Phosphor*. Thereafter I was not long in succumbing to the artistic simplicity of idealism.

It took me many years to learn that neither phosphorus et cetera nor the streams of thought could be dealt with so simply.

The proportions.

BRAIN : THOUGHT = LIVER : BILE

or

BRAIN : THOUGHT = KIDNEY : URINE

are obviously fallacious; but, if we alter the proportions slightly to

BRAIN : PROCESS OF THINKING = LIVER :
PROCESS OF SECRETING,

and

BRAIN : PROCESS OF THINKING = KIDNEY :
PROCESS OF EXCRETING,

we have destroyed the fallacy which James ridicules. We find

that liver and kidney activity have one important thing in common with the stream of thought—namely, activity itself, the temporal features of all processes whatever.

Ah! one more interactionist, I hear you say. No, I reply, that would hardly be fair: How can we prattle interaction, if we don't know the factors we declare to interact? These factors in the interaction-complex, I repeat, we simply do not adequately know either in the concrete or in the abstract.

If not a parallelist and not an interactionist what remains for a student? Must he not relapse into crusty mere critique or cowardly agnosticism?

Some years ago I ventured from my chosen path of brain analysis in mental disease at large to a discussion of dementia praecox in particular. I found that practically everybody had taken sides. It had become a game: the hypothesis of psychic factors was strictly opposed to the hypothesis of encephalic factors. Tangles and twists in the mind appealed to some: blots and spots in the brain appealed to others.

Contrary to my presuppositions (I do not pretend to be exempt from presuppositions) I found in the brains of subjects suffering from something like dementia praecox, certain lesions, partly congenital anomalies, partly lesions acquired in the individual's life. I was led for the moment, and still feel the impulsion, to confide in the brain-spot hypothesis for *dementia praecox*.

Ah! then the secret is out! The writer believes that there are compartments in mental disease such that mind twists work here, brain spots there? No, I reply, I am not so naïve as that, nor are the facts so simple.

"They quote you," said a practical psychotherapist to me the other day, "to the effect that dementia praecox shows lesions, and is therefore incurable, and is anyhow not subject to my poor psychotherapeutic efforts."

"Who quote me?" said I.

"Why, the materialistic doctors of the clinic!"

This was the sequel of my well-meant endeavor to work on an apical problem! The facts are these: I am not convinced that we can safely entify dementia praecox in the first place. I am not sure that the anomalies and scleroses which I found are primary causes in the group. I am still less of the opinion that the changes are secondary to mental twists. I think the lesions are such as to interfere with proper cerebration, just as water on the knee interferes with proper walking.

"I have no objection to the lesions of dementia praecox,

if you do not regard them as *primary*," wrote one friend to me. Precisely, I reply. The lesions are neither primary nor secondary. They, or the cell-arrangements involved permit or purvey the symptoms and signs of dementia praecox. The same facts viewed from one aspect are structural, from another aspect functional. Structure is in the main the spatial aspect of facts and events, function in the main the temporal aspect of the same facts and events. To say that mind precedes matter, or matter precedes mind is to say that time precedes space or space precedes time. If you look sharply at a frozen moment held as a sort of preterite before your eyes, you will hardly discover more than something structural. If you follow the object for a time, you will discern inner or outer changes in the object, qualitative, quantitative, positional, or relative, which entitle you to describe the object only in functional terms.

Brain changes and mind changes have at least this temporal aspect in common: whether both types of change are concretely identical is for research to decide. Pedagogy, the logic of the past, can decide nothing of the sort. Both types of change in virtue of being changes, *überhaupt*, are opposed to the structural, *ex hypothesi* unchanging, killed, fixed and mordanted objects which neurology describes.

Suppose then *for teaching purposes* we keep structure and function apart; suppose we even go a step farther and *for teaching purposes* separate function into two kinds, cerebral and psychic, I maintain that in research we should let the facts lead us where they will, over the hills and dales of physiology, into the deep borings of anatomy, or upward into the ethereal reaches of psychology. We have already weakened the pedagogical boundaries of many ancient sciences, and by new surveys, protracted litigation, and a thoroughgoing disrespect for precedent *coram factis*, we may achieve shortly new boundaries.

The majority of cases of mental disease are, I am convinced by special studies, characterized by the occurrence of obvious brain-lesions, i.e. even in the present stage of science they possess a structural pathology. Do they therefore possess no functional pathology? Their possession of the two aspects is a truism. Should we not study both aspects?

Furthermore, suppose we learn that, whereas three-quarters of our cases of mental disease exhibit obvious irrecoverable brain-lesions, another quarter fails to show these. Suppose the methods of microscopic research should still fail to show in many cases essential or irreversible brain-lesions,

should we not stultify ourselves if we did not abandon *for the research campaign* both that psychopathology which has taught us the main course of our disease and the neuropathology which has proved usefully negative? Should we not repair at once to the chemistry of metabolism, the physiology of internal secretions, and the entire point of view of pharmacology? Discoveries in the latter fields, concrete and pertinent facts, would carry us back to the tissues and back to the processes of the nervous system, to neuropathology, structural and functional, and to psychopathology, and enlighten many dark corners therein. He who adheres to the classical problems as they lie within the teaching divisions of any science is not apt to change the face of that science.

A PIGMENT COLOR SYSTEM AND NOTATION¹

By A. H. MUNSELL

It may be assumed that this audience is acquainted with previous schemes by Lambert, Rünge, Chevreul, Benson and others:—also experimental results obtained by Maxwell, Helmholtz, Koenig, Rood, Abney, Wundt, Hering and Nagel.²

The germ of the present system was a twirling color model made in 1879 when as a student of painting I read Professor Rood's "Modern Chromatics." Experience with many students since then has led to its elaboration in a hope to clarify some of the vague and even false notions frequently entertained.

It is an experimental system built up with the aid of a new photometer, Maxwell discs and the trained capacity of the painter,—using a consensus of many individual decisions to gain the mean of color discrimination. A value scale (painter term for luminosity) was first made by measured dilutions of India ink, furnishing sixteen supposedly equal intervals from black to white. A *middle* value in this scale was next determined by the average choice of artists, dyers, salesmen and students to whom it was submitted, and from this middle point the gradations to white and black were equalized by Maxwell discs. But the eye detected a lack of continuity in the two halves of the scale, which was then rejected in favor of a logarithmic progression.

Thus, unsuspected, the law of sensation dictated the scale of values, instead of the intensity scale common to photometers, and the present daylight instrument was devised to preserve the conditions of studio practice, after having discarded the usual dark room installations with artificial light. An Aubert diaphragm was used to approximate the law of sensation:—but later, in constructing scales of *chroma*, an exception to the law was encountered, which has been noted elsewhere.³

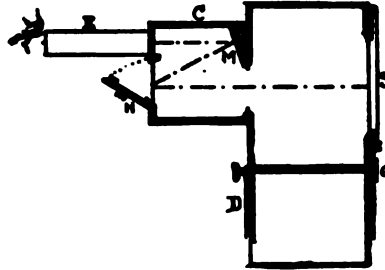
¹ Read before the American Psychological Association, Washington, Dec. 27, 1911.

² Lambert, 1772. Rünge, 1810. Chevreul, 1890. Benson, Clerk-Maxwell, 1860. Helmholtz, 1867. Rood, 1879. Koenig, 1894. Abney, 1896. Wundt, 1880. Hering, 1878. Nagel, 1908.

³ *Psychol. Bulletin*, VI, 1909, 238 f.

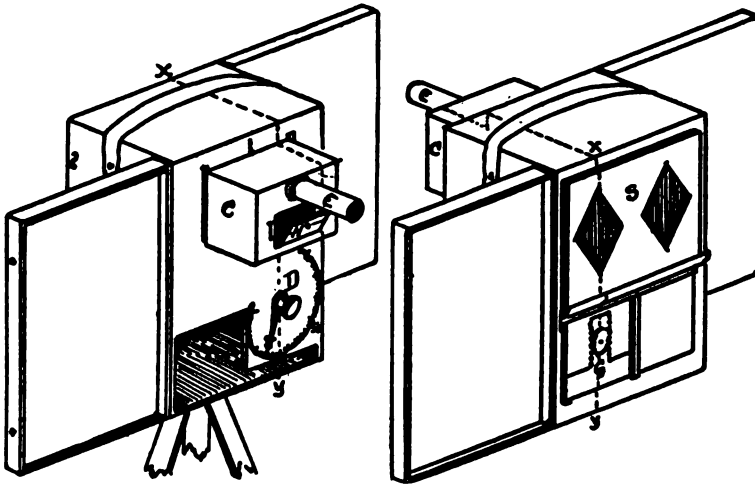
Method of classification

(Summary by Dr. L. J. Henderson of the solid described in "A Color Notation.")



"The principle of this classification of colors depends upon the recognition of three dimensions:—*value*, *hue* and *chroma*.

"These three dimensions are arranged as follows. A central vertical axis represents changes in value from white at



the top to black at the bottom,—the progression being a logarithmic one to correspond with the Weber-Fechner law.⁴ The value of every point on this axis determines the level of every possible color of equal value.

⁴ HELMHOLTZ. *Handbuch der Physiologischen Optik*, zweite Auflage. Hamburg, 1896, 384-480.

"Radial planes leading from this axis correspond each to a particular hue. Opposite radial planes correspond invariably to complementary colors: any three planes separated by 120° form a complementary trio, etc. Thus the angular position of any hue is determined, and the hues are balanced.

"Chroma, or intensity of hue, is measured by the perpendicular distance from any point to the vertical axis, and the progression of chroma is an arithmetical one, constituting the exception to the law already noted.

"Thus is constructed a solid. In this solid every horizontal plane corresponds to one and only one value. Every vertical plane extending radially from the central vertical axis contains colors of but one hue. Finally, the surface of every vertical cylinder having the vertical axis as its principal axis contains colors of equal chroma.

"In this solid every point corresponds to one and only one color, of definite value, hue and chroma, and when these three dimensions of a color have been measured its position in the solid is at once obvious."

What material form shall be given to this theoretic color solid? Spectral color would be the first suggestion because of its purity and the perfection of its instruments. But were it possible to embody the theory in spectral form, there would still remain its translation into pigments for the daily applications in education and industry.

There are serious pigment difficulties which must be met, such as fading and chemical reaction; and long technical experience is needed in handling pigments, so that inequalities of texture left by the brush, and uneven transparency affecting the relation of body and surface light⁵ may not falsify results. The medium employed,—whether wax, oil or water, still further complicates the problem. Yet despite these limitations, some tolerably permanent visible form must be made and therefore pigments seem indispensable.

To meet these difficulties, expert knowledge is needed to devise tests and safeguards which will give the nearest approximation to uniformity. The scales must be made with the fewest possible pigments, which long exposure will not fade, and after careful scrutiny of their chemical composition. To avoid irregular behavior in the reflection and absorption of light, those selected for this system of charts have been ground in media which gives a matt surface when applied to a special ground.

⁵ WILHELM OSTWALD. *Letters to a Painter*. Boston, 1907.

Each step in the united scales of value, hue and chroma is prepared by weight, brought to a proper consistency and applied with uniform brush work. If the resultant sheet fails to satisfy the three measuring tests it is discarded. This method is continued until a final sheet succeeds, and from this accurate sheet are cut the squares of color appearing on the charts. Protected from dust and the furtive hand, these scales will suffer only a slow change observable under the best conditions of opaque pigmentation. Visual discrimination being rarely less than two per cent^a these changes are negligible for a long interval, after which fresh sheets will be supplied.

A color sphere established by the test of visual balance

Desire to fit a chosen contour, such as the pyramid, cone, cylinder or cube, coupled with a lack of proper tests, has



led to many distorted statements of color relations, and it becomes evident, when physical measurement of pigment values and chromas is studied, that no regular contour will serve. If a regular contour is desired, it will be necessary to bring the unbalanced character of pigments to a balance of complementary qualities, by selecting hues of equal light, strength and area.

For this purpose Rünge's sphere (1810) offers a convenient test, although the test at once reveals errors into which he fell:—partly by unmeasured assumptions as to the strength and light of colors, and also by the false but popular theory on which he worked. Strange to say that theory is still prevalent in primary education, although rejected by science for half a century.

Neutral gray is at the center of the sphere. It represents a balance of pigment mixture as white light represents the

^a CHARLES PIERCE. Note on the sensation of color. *Amer. Journal of Science*, XIII, 1877, 249 ff. (Photometric sensibility of the eye the same for all colors.)

union of spectral hues. A circuit of pigment hues around the equator is formed of five complementary pairs,—all of equal chroma to accord with equal departure from neutrality, and of equal value to accord with the central level. The sphere is mounted so as to permit rapid rotation, which melts this equator of ten balanced hues in a band of neutral gray, proving by this visual balance that all degrees of sensation are compensated and constitute a true color equator.

Lighter zones to white and darker zones to black are similarly established, and at high speed the spherical surface fuses into a neutral gray, reproducing the axis with its regular scale of values from white to black. This retinal fusion begins to break up as the speed slackens, until a point is reached where a certain rate of presentation causes this hue-sequence to appear almost prismatic in vividness.⁷

This color sphere is evidently smaller than the complete color solid,—its equator being restricted to the chroma of the weakest pigment, since any enlargement of the diameter would leave that hue space vacant and destroy the balance. (Black pigments reflect nearly 20% of light and to balance this at the pole, a light grey replaces white.) The weakest pigment is a blue-green known as Viridian (sesquioxide of chromium), whose red opposite, Vermilion (sulphuret of mercury) is the strongest, with a chroma double that of Viridian. Hence, the equator of the sphere presents only the "middle" or half chroma of Vermilion with chromas less than the maxima in every case except that of Viridian.

The maximum red chroma therefore projects beyond the sphere and is below the level of the equator, with the purple and blue maxima lower still, while the maximum of yellow occupies a very isolated position nearly on a level with white. When these very uneven maxima projecting beyond the spherical surface are connected by intermediate mixtures and their series to white and black, they describe a most irregular shape which may be termed a *color tree*. The white-black axis becomes the trunk of this tree with branches extending horizontally to the maxima of red, yellow, green, blue and purple:—and upon studying its uneven contour, the "color belt"⁸ is found to be a complex circuit whose steep inclination to the axis is a quantitative and qualitative statement of the strongest pigment mixtures.

⁷ Probably produced by most favorable moment of fatigue of the complementary sensation.

⁸ HOWARD C. WARREN. The Form of the Color Pyramid. *Psychol. Bulletin*, VII, 1910, 51f.

In this color solid the relation of axial length to diameter is an interesting question:—a space relation involving a study of the greatest number of discriminations in the white-black series as compared with a similar series of discriminations in the hue circuit. Also of chroma discriminations possible between complementary maxima. Koenig is quoted as ascribing seven hundred distinguishable grays to the axis with only one hundred and sixty distinguishable hues,—while Aubert⁹ increases the latter series to more than a thousand. For a definite study of this ratio in terms of spectral hue and chroma, the apparatus described by Yerkes and Watson¹⁰ seems admirably adapted.

This being a *pigment system*, led to inquiry among dyers and makers of colored stuffs, where one finds some twenty practicable grays as against more than seventy practicable hues in imitation of the circuit: and since the color belt—whether spectral or pigmentary—contains the differences of the white-black series plus the purples, it seems natural to infer that the belt presents the larger number of steps.

The angular distribution of hues is such that a single plane containing the vertical axis selects complementary pairs as determined by visual balance. When three planes separated by 120° are employed the retinal balance is composed of three sensations, while two planes mutually perpendicular give a balance of four sensations.

Another test consists in taking the opposite of red—blue-green—and separating blue from green by 72°. If this be the proper angle they will unite in a blue-green chroma corresponding to a chord joining them, and any other distribution would unduly crowd or spread the remaining hues of the circuit, destroying what painters call the balance of warm and cool color:—i. e. long and short wave-lengths.

A Color Atlas; charts presenting sections of the irregular color solid

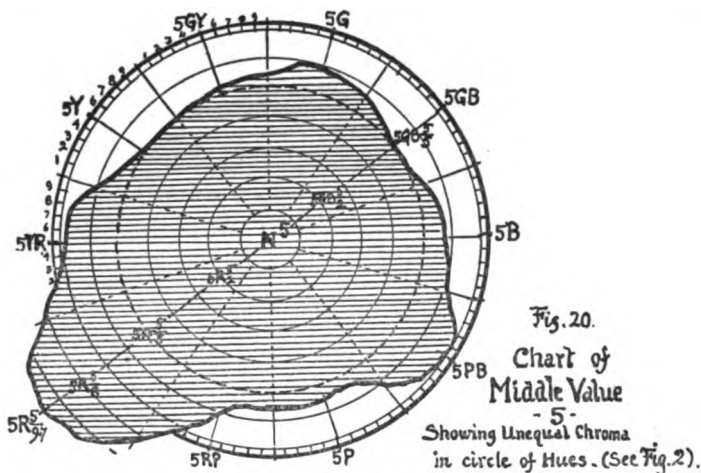
The solid having been built up by equal and decimal steps of sensation, any sections must present regular scales of pigment light and strength. Horizontal sections present colors of uniform value in ten hue-radii of increasing chroma, from the common neutral center to the pigment maxima. Concentric circles contain equal chromas on all radii, and

⁹ H. AUBERT. *Physiologie der Netzhaut*. Breslau, 1865.

¹⁰ YERKES AND WATSON. *Methods of Studying Vision in Animals. Behavior Monographs*, I, 2, 1911.

an irregular outline describes the shape of the color solid at each level.

Vertical sections through the axis present a hue and its complement, in every step of value and chroma. A circle struck from middle gray shows the limit of the color sphere, the ends of each diameter selecting balanced complements. Oblique sections trace regular sequences which involve change of hue, value and chroma at each step. Such a series including the strongest yellow and strongest purple-blue gives a pigment imitation of the spectrum plus the missing purples.

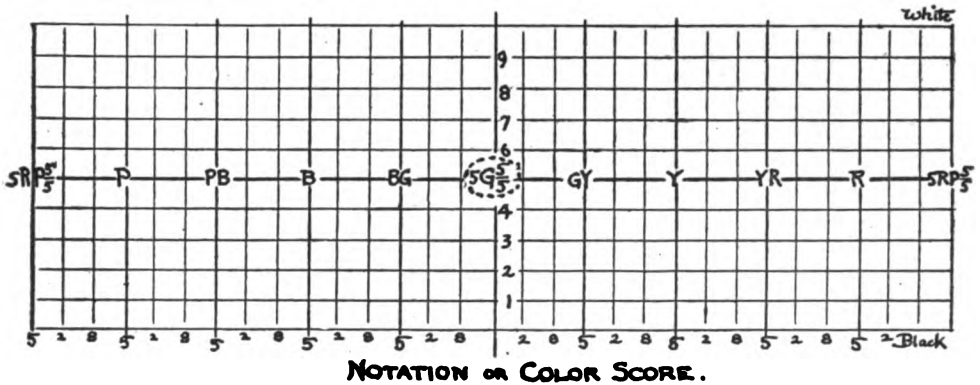


A Color notation¹¹ for records and comparisons

On each chart the steps of color interval are described by a simple notation consisting of an initial and four numerals. This gives their exact place in the related scales of value, hue and chroma. The hue scale is a closed circuit of ten equal steps traced by the initials of the five principals and their intermediates. It is written R (red), Y (yellow), G (green), B (blue), P (purple), and the intermediates YR, GY, BG, PB and RP. Each of these hues is in ten steps of value from black (0) to white (10) and also in ten steps of chroma from neutral gray (0) to the strongest maximum (10). An intersection of these three scales is written by an initial for the hue, a numeral above the line

¹¹ A. H. MUNSELL. *A Color Notation*. Boston, 2nd edition, 1907.

for value and another below the line for chroma. Thus "Middle Red" (midway between extremes of value and chroma) is written 5R $\frac{1}{2}$. When first seen on the equator of the sphere this degree of red is likely to be rejected as untypical: yet it is the type which appears most frequently in beautiful combinations, while the extreme red generally taken as typical is usually absent, or if a small touch is introduced as an accent, it will be found to balance with a correspondingly large area of the weaker blue-green. When fixed in the visual memory, this middle red permits the thought to range by equal degrees to the limits of luminosity



and strength, just as in musical training the middle register is the basis of judgment for the extremes.

Any variation of this middle red is at once defined by the notation. Thus $4R\frac{1}{2}$ is a slight change toward crimson without change of value or chroma. $5R\frac{1}{2}$ indicates no change of hue or chroma, but a lighter value of red, while $5R\frac{1}{2}sp_{100\%}$ unchanged hue and value, but with a weaker degree of chroma. This method applies to every point in the color solid, and by means of decimals, finer differences are possible up to the limit of visual discrimination.

A Color Score is provided for recording color groups and sequences

Suppose a transparent cylindrical envelope placed around the equator, and cut open at the red-purple meridian. This envelope spread flat is like a Mercator projection permitting us to plot any points of the color solid. It presents a rec-

tangular chart traversed by ten equidistant hue meridians, which are crossed by ten horizontal parallels of value. *Middle green* occupies the center of the chart, where the green meridian intersects the equator. Every point on this chart is equally significant of a certain value and hue, at the side of which may be written the intended chroma. Not only defining the *kind* of color sensation, this chart shows the *quantity* of any color by an enclosing line which is an expression of area. Significant curves traced on this score of measured scales describe individual sensitiveness to color. They serve to plot the groups and sequences which individuals find agreeable or the reverse. They also tabulate any desired or imagined combination of colors, and with practice in notation may be used to fix the memory of natural effects too fleeting for prolonged study.

Finally, by aid of the charts and models, there is set up a fixed mental image of all color relations.

The limits of this paper exclude reference to other practical applications of a definite color method in scientific and artistic education:—but one may feel justified in the hope that by providing what seems to be a sound mathematical basis for the description, comparison and classification of colors, there results an instrument that may be of use to psychologists.

AN EXPERIMENTAL STUDY OF MUSICAL ENJOYMENT¹

By HARRY PORTER WELD

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I. INTRODUCTION

The investigation which is here reported aims to make a contribution to the psychology of the appreciation and enjoyment of music. A variety of musical compositions were employed; plethysmographic and pneumographic records were made throughout. The chief aim, however, was to obtain a detailed and accurate description of the mental processes

¹ From the Psychological Laboratory of Clark University.

which were present, and to correlate these findings with the type of observer on the one hand, and with the type of musical composition on the other. It has been our hope to throw light upon the following problems: How does music produce its effects? What are the bodily correlates of musical enjoyment? What are the limits within which pure music may be used as a means of expression? What are the differences in the mental processes involved in the various sources of musical enjoyment?

II. HISTORY OF THE PROBLEM^{*}

The psychology of musical enjoyment is intimately related to the problems of aesthetics; and it is impossible to review the literature of the former without taking the literature of the latter into account. With the problems of speculative aesthetics we are not immediately concerned. We shall therefore confine our attention, so far as possible, to those studies which have a direct bearing upon the specific topic of our investigation; and we shall venture into the field of the aesthetician only in so far as such a course seems to be demanded in the interests of a clear and systematic presentation of the findings of previous investigators of our problem.

Several writers have raised the question: To what extent is musical composition adequate as a vehicle of expression? Gilman (130), the pioneer investigator of this topic, employed a method which consisted in playing a program of thirteen carefully chosen selections (piano and violin) before an audience of thirty non-professional musicians; and the auditors were asked to answer certain definite questions regarding the effect of the music upon them. Downey's (128) method was similar to Gilman's save for the fact that she employed fewer musical compositions, in order to avoid fatigue, and she asked no definite questions, in order to eliminate the influence of suggestion. The results of both these investigators were negative in so far as concerns the ability of the composer to communicate scenes, incidents, or ideas (non-musical) to all of his auditors in common; but they indicate that music may arouse the same mood in the minds of several auditors. The investigation was continued by Ferrari (129) and Lahy (13) who refined the method but obtained essentially the same result.

Another question which has been attacked by investigators is this: What is the nature of the bodily reactions,—changes in the rate of heart-beat and in the distribution of blood supply, changes in the function of respiratory and other muscles,—which result from auditory stimulation? The pioneer investigations of Dogiel concerning volu-

^{*} As originally prepared, this paper included a detailed description of the several contributions which have been made to the solution of various problems which are directly or indirectly concerned with the topic of our investigation. But the necessity for condensation has resulted in the sacrificing of certain sections, and the curtailing and recasting of others. In several instances, we shall be able to do no more than refer the reader to the papers which are listed in our classified bibliography. We hope to return to the discussion of various points which have been raised by previous investigators.

metric changes possess no more than historical value. Féré (94) reports that isolated notes and 'scales' have a dynamogenetic effect whose magnitude varies with their pitch and intensity. This result was confirmed by Tarchanoff (119) who also found that 'gay music or music of rapid tempo' neutralizes the effects of muscular fatigue; and Scripture (118), employing *motifs*, instead of isolated tones and simple sequences of tones, reports that he has confirmed the finding of Féré. In an investigation of the knee-jerk, Lombard (116) found that the amplitude of this reflex is increased in the presence of musical compositions,—and increased in different degree by compositions of different character. In a subject, part of whose skull-wall had been removed, Patrizi (117) was able to observe that tuning-fork stimuli and musical compositions increased the volume of the brain; but he failed to find that volumetric differences are correlated with differences in the character (gay or sad) of musical compositions. In an investigation of the effect of musical compositions upon pulse and respiration, Mentz (104) found that a retardation of pulse occurs with perfect consonances, with significant changes of tonal intensity, with the approach of the *finale*, and with the emotion of pleasantness; the heart-rate increases when the auditor concentrates his attention upon the composition and attempts to analyze it. Binet and Courtier (111) employed consonant and dissonant chords, major and minor intervals, etc., together with fragments of musical compositions, in an investigation of this same problem. They found that all of their auditory stimuli produced an acceleration of heart and of respiration; this acceleration was greater in the case of dissonant chords, major chords, and chords in rapid succession; the effects of musical composition are more intensive than are the effects of isolated chords. Gibaud's results (115) show an utter absence of uniform correlation between consonance and volumetric change,—a negative finding which this investigator refers to individual differences among his observers. Ferrari (113) made plethysmographic records of the effects of music upon normal and pathological auditors. Only in his idiotic and insane subjects did he find any vaso-motor change which could be correlated with musical emotion. The author refers these changes to an assumed absence of cortical control; and he employs his results as an argument against Lange's envisagement of the emotive process. Foster and Gamble (114) found that the effect of music upon respiration is similar to the effect of mental application in general, in so far as rate and amplitude of breathing are concerned; but they report that the regularity of respiration, which is characteristic of mental work, is lacking in the presence of music. In an investigation of the relation between 'Organic Change and Feeling,' Shepard (106) included a few experiments in which the effects of music were recorded by means of a plethysmograph. Agreeable and exciting music was invariably attended by a more rapid pulse, agreeably depressing music by a shorter pulse.

III. EXPERIMENTAL

1. *Preliminary Experiments.*—Our investigation includes a few preliminary experiments which were undertaken with a view to obtaining a general survey of the field, and a group of more accurately planned experiments which occupied our attention during the years 1910-11.

In the preliminary experiments, we had eight observers; five compositions were repeated at intervals with each observer, and the observers were asked, in the most general terms, to describe their experiences

under the influence of the music. These selections were played upon a pianola-piano; and in later experiments, a Swiss music box was employed. One hundred and forty introspective descriptions were obtained from these two preliminary groups of experiments; and these were supplemented by forty pneumographic and plethysmographic tracings. This preliminary survey of the field also included a printed list of questions which was sent to fifty of the most noted composers, critics, and teachers of America. It was hoped, by this means, to obtain information regarding the musical experiences of a great number and a great variety of auditors; but this mode of attack upon the problem proved to be barren of result, and none of the data which were obtained in this preliminary survey will be incorporated in the present paper, excepting in two instances where they will be referred to in passing.

The data upon which this paper is based were obtained in an experimental investigation of the problem which was undertaken in the psychological laboratory of Clark University. Our method of investigation consisted essentially in playing a variety of compositions in the presence of an auditor, and in obtaining plethysmographic and pneumographic records of such bodily changes in circulation and respiration as may have occurred before, during, and immediately after the rendering of the composition; and, in obtaining detailed introspective descriptions of such mental processes as were present.

2. *Apparatus.*—The apparatus consisted of a Lehmann plethysmograph and two Sumner pneumographs; one of the pneumographs recorded the thoracic, and the other the abdominal movements of respiration. The tracings were recorded by means of Marey tambours upon the smoked drum of a Zimmermann kymograph; the kymograph was so adjusted that the drum made one complete revolution in five minutes. A time line, marking seconds, was recorded upon the drum by means of a fourth tambour which was actuated by a metronome; the metronome stood in an adjoining room, and every care was taken to make our apparatus as nearly noiseless as possible. The music was furnished by a Victor Talking Machine (Model V.). This machine was equipped with a wooden horn; and fibre needles were employed throughout. In order still further to reduce the slight grinding noise, the Victor Machine was inclosed in a box, from which only the bell-shaped end of the horn projected.

The phonographic records were carefully chosen to avoid imperfections and to secure the best possible timbres. These compositions represented contrasts in tempo and rhythm, in form and style; and they included reproductions of the violin, cello, xylophone, string quartette, orchestra, concert band, and

military band. A list of these selections, with the metronome rates at which their various sections were played is appended:

Cradle Song, *Hauser*, Cello (60-63); Rondo from *Serenade*, Op. 525, *Mozart*, String Quartette (116); Diplomat March, *Sousa*, Concert Band (116); Angel's Serenade, *Braga*, Violin and Cello (126); Fifth Nocturne, *Leybach*, Violin Solo (50); New Tipperary March, *Fulton-Helf*, Military Band (120); Serenade, *Pierre*, Instrumental Quartette (88-92); Merry Widow Burlesque, Orchestra (160-132); Norma Selection, *Bellini*, Military Band (126-168-42-168); Mignon-Gavotte, *Thomas*, String Quartette (92-96); Songe d'Automne, Orchestra (62); Berceuse, *Godard*, Violin (42-52); Melody in F, *Rubenstein*, Violin (76-72); A Hunt in the Black Forest, *Voelker*, Orchestra (60-176-116-176); Minuet, *Paderewski*, Orchestra (120); Pearl Fishers Selection, *Bizet*, Concert Band (88-84-72); The Spinning Wheel, *Spindler*, Concert Band (13); Prize Song from *Meistersinger*, *Wagner*, Cello (69-66-63); Ernani Selection, *Verdi*, Concert Band (104-172-46-76); Leonore Overture No. 3, *Beethoven*, Concert Band (138-144-164); Badinage, *Victor Herbert*, Cello and Orchestra (116); Carnival of Venice, *Benedict*, Xylophone Solo (69); Humorous Variations on a German Folk Song, *Wollweber*, Concert Band (92-164-66-60-88); Hungarian Fantasie, *Tobani*, Orchestra (69-154-63-152); Carmen Selection, *Bizet*, Military Band (152-116); Spanish Waltz, *Nathan*, Concert Band (104).

3. *Method*.—Our method aimed to institute a detailed comparison between an auditor's normal respiration, heart-beat, and distribution of blood-supply, and the same auditor's respiration, heart-beat, and distribution of blood-supply while listening to music. The experiments were carried on in a quiet room on the third floor of the main building of the University. At the beginning of each experiment the auditor took his seat in a Morris chair with his back to the light; his right arm was adjusted in the plethysmograph; and the pneumographs were fitted to his body. Every precaution was taken throughout to eliminate any discomfort or distraction which might arise from the presence of the apparatus.

The reader need scarcely be reminded that a failure to observe these precautions would have vitiated the investigation; and he may be assured that, notwithstanding the fact that a complicated apparatus was employed, the auditors testified that their attitude and reaction were, after a few preliminary sittings, identical with their attitude and reaction to the rendering of a musical program under ordinary conditions. Indeed, the writer was surprised to discover that the auditors were wholly oblivious to the presence of the apparatus, save in two instances which will be discussed later. Not only did they report that they gave themselves up to the enjoyment of the music, but they also reported that they even were oblivious in most instances of the fact that the music was a phonographic reproduction,—they actually seemed to be in the presence of a quartet and orchestra, and they seemed to see the violinist, the conductor, and the various musical instruments.

When the plethysmograph and the pneumographs had been adjusted and had been connected with the tambours, a 'ready'

signal was given and the auditor composed himself as passively as possible. After a brief pause which was introduced in order to allow the auditor to recover from the distraction of the signal, the kymograph was set in motion and a preliminary record of the normal heart action and respiration was obtained. When the kymographic tracings indicated that passivity had been present for thirty or forty seconds, the music began.

The observer had been instructed to listen to the music in whatever way he pleased, but preferably in the way in which he usually enjoyed music. He had been told that when the music ceased, he would be asked to give a description of his experiences. The reader may suspect, as indeed the writer did suspect, that these instructions may have influenced the observer's attitude and reaction to the music. For this reason, control experiments were introduced in which the observer was assured that he would not subsequently be asked to give an account of his experiences. Every observer, without exception, reported that his attitude and his enjoyment were, so far as he was able to discover, identical in the two cases. Vocal music was not employed in our experiments; the name of the composer and the title of the composition were at all times withheld from the auditor, and no verbal or other extrinsic suggestion was given as to the nature or character of the selection.

Each composition required from three and one-half to four and one-half minutes. When the drum of the kymograph had completed its revolution, it was stopped and the observer began immediately to dictate his introspection. If, when he had finished his recital, any manifest variations in his kymographic tracings still remained unaccounted for, the experimenter attempted, by means of carefully worded questions, to lead him to supplement his description. A record was kept, not only of his answers, but of the exact wording in which the questions had been formulated.

4. *Observers.*—The observers in this experiment were all students in the Psychological department of this University. They were Misses S. C. Fisher (Fs.), B. E. Roethlein (R.), M. Van Waters (V.), E. L. Woods (W.), Messrs. E. S. Conklin (C.), E. O. Finkenbinder (Fn.), L. D. Hartson (H.), and G. H. Shafer (S.). All of these observers sing; H. is a vocal soloist. Fs. plays both piano and violin. R. and F. play the violin and H. the cello. W. has studied both piano and the voice but plays and sings little. C. and V. have studied no instrument. S. has sung in choirs, has taken a few lessons in singing and plays organ and piano in desultory fashion. As to ideational type, R. and V. are predominantly visual-motor, their auditory imagery is negligible. C. and S. are motor-visual with little if any auditory imagery.

H. and W. are motor, auditory, visual in the order named. Fn. and Fs. are of the balanced type with auditory imagery occupying a more important place in their ideation than is the case with any of the other observers. Especially does this hold true in the case of Fn.

IV. RESULTS

I. PHYSIOLOGICAL

Our plethysmographic and pneumographic records were undertaken chiefly for the purpose of controlling our introspections; but the physiological changes which were revealed are themselves of interest.

A. *Volumetric Changes*.—The act of listening to music was almost invariably attended by a decrease in the volume of the fore-arm; this phenomenon occurred in ninety per cent. of our cases. The decrease occurred almost immediately,—within two to five heart-beats after the music began. Certain auditors are characterized by the fact that this initial drop in the volumetric curve is abrupt and precipitous; while in other auditors the change of level in the plethysmographic curve is always gradual and of relatively slight amplitude. It is an interesting fact that the former group of auditors are more active, more alert, more volatile, while the latter group tend to be more indifferent, more phlegmatic, more deliberate. The subsequent course of the curve assumed one of several forms: it either remained at a low level throughout, or it gradually rose to about the initial level and there remained, or it ultimately attained a height above the level of the fore-period. In addition to these changes in the general course of the curve, it frequently happened that the plethysmogram showed a brief undulation, in an upward or downward direction, at some point in its course.

The writer is convinced that these volumetric changes are essentially phenomena of attention; it proves to be possible, in every instance, to correlate these characteristic changes with changes in the nature or condition of attention. After the experimenter had obtained an insight into the individual differences among his auditors, and had acquired experience in the interpretation of his plethysmograms, he found it possible to predict what phenomena of attention would be described in the auditor's introspection. For instance, when the volumetric curve, after its initial fall, continued at a low level throughout the observer never failed to report a constant, continuous and intensive concentration of attention; abrupt undulations of the curve coincided with abrupt variations of attention or rapid fittings of attention from one objective point to another; a return of the plethysmographic curve to its initial level indicated the presence of relatively passive attention, and an ascent above the initial level is correlated with reverie and dreamy states.

B. *Heart-rate*.—The heart-rate was usually accelerated during the music-period. This acceleration began during the first few seconds, and was usually maintained throughout the whole music-period. There was, in general, no correlation between the tempo of the music and the change of heart-rate,—even the slowest musical tempos, which were much slower than the normal pulse, produced an acceleration of pulse, and the most rapid tempos had no more accelerating effect *per se* than the slowest tempos.

The normal heart-rate (fore-period) of our auditors varied from day to day,—one auditor varying between the limits of 63 and 88, another between 72 and 92. The rate during the fore-period exceeded the rate during the music period in less than ten per cent. of the cases; and it

was found that in all of these cases excepting one the rate during the fore-period had been abnormally high.

This phenomenon of acceleration of pulse proved to be so frequent and so independent of the tempo of the music that we were led to suspect the influence of the suspense and expectation of the fore-period, and perhaps even of relaxation, during the music-period. Accordingly we compared the heart-rate of the first minute and of the second minute of the music-period with the rate of the fore-period. We found that the first minute showed an acceleration in eighty-five per cent. of the cases, and the second minute, in eighty-one per cent. of the cases; the first minute showed a retardation in nine per cent., and the second minute in eleven per cent.; the heart-rate remained unchanged during the first minute in six per cent. of the cases, and during the second minute in eight per cent. of the cases. Our records show no constant correlation between heart-beat and rhythm; and a correlation between tempo and heart-rate is found only in those musical compositions where the observer reported that the rapid tempo produced an exciting effect.

C. *Respiration*.—The most striking changes in the respiration of the music-period are acceleration of rate and irregularity of amplitude. We have been able to discover no relation between increased rate of breathing and musical tempo. In certain auditors the accelerated respiration is also more shallow; in one case there is little or no change in depth, and in certain other cases the amplitude of respiration is so exceedingly irregular during the music-period that it is difficult to compare it with that of the fore-period. A comparison of thoracic with abdominal respiration has revealed no striking or illuminating differences.

In certain of our observers, changes in respiration were by far the most striking physiological effects of music. Those auditors who were characterized by active attention breathed in more rapid and shallow fashion than during the fore-period; while in those auditors whose reaction was essentially emotional, respiration was exceedingly irregular both in rate and in amplitude. (See plate F.) In the latter auditors the respiration tends to 'follow the music,'—to accelerate, to hold, to retard, when the music accelerates, holds or retards; and these variations in rate of breathing are attended by corresponding variations in depth.

f No correlation between respiration and phrasing was discoverable in the records of our investigation. But an additional series of experiments was arranged for the purpose of determining whether such a correlation is present when the auditor attends especially to the phrasing of the composition. Here it was found that the beginning of each phrase coincided either with the beginning of an expiration or with the beginning of an inspiration,—the former occurring much more frequently than the latter.

Our plethysmographic findings, and our interpretation of these results are in accord with the statements of Angell and Thompson (89; 67 ff.). Our interpretation of the abrupt alternations in the volumetric curve is in agreement with that of MacDougall (103; 165). Stevens (108) refers the initial fall in this curve to certain physiological effects which are produced by external stimulation; and while it is true that in our experiments the fall was usually abrupt in proportion as the musical stimulus was intensive, yet our introspections indicate that initial as well as subsequent changes of level of volumetric curve find a much more thoroughgoing correlation with changes

in the auditor's attention than with changes in objective conditions of stimulation. We do not feel that our investigation can furnish evidence as to the nature of those physiological processes which attend the emotional states of pleasantness-unpleasantness and excitement-calm. Under the conditions of our experiments, these emotions came to consciousness in such highly complex form, and such great variations of attention were involved, that the contribution made by the isolated action of any single factor could not be determined.

Our results regarding the effect of music upon heart-rate confirm the findings of Binet and Courtier (111) and of Shepard (106). Mentz (104) however reported that the pulse is retarded when the auditor's attention is passive. We cannot assent to this statement. It is true, however, that if while listening to music the observer's attention is at first active and subsequently becomes passive, his heart-rate will be found to be slower during the latter stage than during the former; but even during the latter stage the rate is faster than it was before the music began. Our negative correlation between pulse and tempo is in opposition with the views of Riemann (28) and of Steinitzer (19), both of whom assumed that the normal pulse is the criterion by reference to which we estimate rapidity or slowness of tempo. Indeed Hallock (79) has carried this so far as to compute the normal heart-rate of Beethoven from an analysis of his sonatas. But we have wholly failed to find any correlation between rhythm or tempo and pulse. In musical productions the length of the rhythmic group varies in consequence of acceleration, retardation, rubato, pause, forced accenting of tones: the pulse does not respond to these variations.

Although in confirmation of the findings of Dogiel (112), Leumann (102), Mentz (104), Meumann (65), Squire (69), and others we have found that respiration is disturbed by auditory rhythms, yet even here there is no constant correlation or coincidence between the auditor's respirations and the rhythms which he hears. The nature of the disturbance is rather a departure from the regularity of normal inspiration and expiration; and this divergence is proportional rather to the intensity of emotion than to the nature of the objective rhythm. Our observation that respiration conforms to the phrasing of the music, when attention is directed to the phrases, supports the contention of Riemann (28).

The respiratory function is more peculiarly adapted than any other function of the whole bodily musculature for the execution of those empathetic and sympathetic movements which are emphasized by the advocates of *Einfühlung* and *innere Nachahmung*. And it is in variations of respiration that one would expect to find that these variations of pause, retard, acceleration and rubato can be imitated as by the bow of the violinist. A survey of the pneumographic records which are reproduced at the close of this paper will show that all of these variations of respiration are illustrated in our findings.

2. INTROSPECTIONS

Our introspections reveal the fact that the 'music consciousness' is made up of a mass of kinaesthetic and organic sensations, motor, vocal-motor, auditory and visual imagery, numerous associations many of which are irrelevant, affective and emotional processes, and various phenomena which have to do with intellectual enjoyment. We shall analyze this material under the following heads: A. Visual Imagery; B.

Auditory Imagery; C. Actual or Imaged Motor Reactions;
D. Reactions to Descriptive Music; E. Emotions and Moods;
F. Individual Differences.

A. Visual Imagery

All of our observers frequently reported visual imagery in connection with their musical experiences. Often, however, this imagery was nothing more than that which is ordinarily concerned with thought processes; it had no direct or peculiar relation to music. Many times it consisted of the visualizing of objects which were associated with previous auditory or motor experiences of the individual,—for instance, one observer visualized *staccato* notes of high pitch as bright points of steel, another as sparks of light, still another as drops of rain falling on water; a flitting movement in the music evoked the visual image of fairies, etc. Frequently also, visual images were called up through association by contiguity; one observer reported 'this composition called up a visual image of the surroundings in which I heard the same composition last night.' Such simple associations have no especial significance for our problem, and need not be discussed further.

With three of our observers the visual image may and often does occupy a very important place in musical experiences. Their imagery is much more detailed; it often assumes the form of a drama or story in which an emotive content is clearly expressed. Usually the form or schema of the drama or story shows a striking resemblance to the form or schema of the musical composition.

Observer R.—Spanish Waltz, Band. 'I was in a ball-room, not dancing but in evening gown. It was a military ball with a military band; officers and women were there. When the music began, I saw a dance which I had never seen or danced before, but it was appropriate to the music. First, each couple danced two turns together, then jumped. Then the man of one couple took two steps to the left, the girl two steps to the right, and the *vis-a-vis* couple approached and passed between. Third, the first couple came together and the second pair took the place which originally had been occupied by the first. The former pair approached and passed through as before. Every one was laughing and having a good time, because it was a new dance. Then I saw another dance; same surroundings. A man moved toward a woman and made a courtesy to the movement of the music; they did not turn but went backwards. This was done slowly—very slowly. I could not get the exact step; I could not follow it though I tried, because the lady's dress attracted me so much. When this dance was over, the original couple were standing in their original position, and each person made a low courtesy. Everybody seemed to be waiting for something; all were standing in a row. Suddenly the first dance began again; but now there was a slight variation because they were not standing in exactly the same positions.'

An analysis of the above image or scene reveals the presence of three distinct dances; the first, lively and accompanied by much laughter; the second very slow with no turning but with courtesies; and the third, a repetition of the first. A musician will instantly recognize this analysis as a good description of that form in music known as Simple Ternary,—a form in which many compositions of this class are cast and which is usually described as consisting of three sections, the third a repetition of the first, and the second in well-marked contrast to the other two. If we represent this form by the symbols A B A, it will be clear that the first dance of the image lasted throughout the first A of the music; the second dance occupied the B of the music; and the third dance, the second A. So far as the observer was able to recall the exact movements of the dance, they coincided with the phrasing of the music; the place in the first dance where the participants 'jumped' is clearly suggested by a 'wide interval' ascending in pitch at the close of the phrase.

Observer R.—Thomas, Mignon Gavotte. String Quartette. 'When the music began, a friend appeared by my side. Near by was a hotel containing a little theatre. We were looking out of our window, and through the window of the theatre we could see everything on the stage. Women were on the stage singing; their faces expressed emotion; they seemed to be telling something but before they got to the point, they changed their minds and stopped. We were so far away that we could not hear the words but we saw them acting it out. Then men approached upon the stage; they sang the same thing, and stopped just where the women had stopped. When the men had finished, the whole party left the stage except one woman and one man. She began to tell him of her love but stopped and left her recital uncompleted as before. Then they both sang in duet to the end. All was happy and gay. We enjoyed it thoroughly; we could not refrain from giggling as we looked on the stage and saw the performance.'

(When the observer had finished her introspection, she was released from the apparatus and the music was played a second time for the purpose of determining exactly at what point in the selection each change in the observer's picture had made its appearance. It was found that the setting (picture of a stage) had been suggested by the opening chords of the music. The observer was entirely unable to explain why the setting should take this particular form; she reported, however, that *pianissimo* effects always suggested distance,—'It is far away; I am not there.' She could recall no experience in her life which could explain why this particular group of imagery now came to her consciousness except that once many years ago, from a fourth story window, she saw a procession upon the street. After the opening chords, the song of the women continued until the repeat; at this point, the men took up the strain and sang to the end (double bar). The contrast section was pictured by the observer as being not vocal but instrumental, during which the chorus withdrew; and during the

recurrence of the first section, the two voices carried the melody which had formerly been sung by the combined male and female chorus.)

Observer V.—Biset, Pearl Fishers. Military Band. 'I saw street Arabs in the Midway;—then I saw soldiers dressed in electric blue; sometimes it seemed like a circus parade—then like a military parade. The scene changed toward the end, and I seemed to be in a church. I heard the organ but could not see the organist. I saw robed figures; as they marched, something swayed back and forth, maybe censors. Near the end where the heavy chords came, I thought of a triumphal anthem and 'I went along with it.' In the next experiment, five days later, this composition was inadvertently played a second time. The robed figures came in as before; but on a stage instead of in a church. 'The priests came on the stage, the pipe-organ was on the stage; I did not feel the triumph, but I felt a solemn thanksgiving—not exultant as before. I think the change was due in part to a change in mental attitude; all the sincerity of it was gone. Before, I lived it. Then the priests were in church, they were really celebrating a triumph in the Middle Ages. Now, it was acting on the stage.'

Several features of these introspections and of numerous similar introspections which might be cited, are significant. (1) The imagery is invariably full of movement; this is characteristic not only of every visual image of this type reported in this experiment, but also of visual images in the preliminary experiments. (2) These movements always bear a direct relation to the 'movements' of the music,—such as rhythm, phrasing, etc., often changes in pitch where such changes are characteristic. In the case of observer R., we have several times compared the images, phrase by phrase, with the music. The outline of the imaginal experience invariably conforms to that of the music. If the movements of the musical composition are rapid and fitting, the movements in the visual imagery are rapid and fitting. If there is a sudden pause in the music, the movements of the imagery suddenly come to a stop; then as the music continues, the movement of the imagery continues. If the melody of the music is often repeated, the movements of the imagery are as frequently repeated. The fidelity with which the imagery follows the movement of the music may be more clearly seen in the fact that if the imagery is localized upon a stage, as frequently happened, R. never sees the curtain fall. The figures on the stage continue their movements until the music stops; at that instant, the whole imagery melts and disappears like a fairy scene. While no one of the eight observers in this experiment had such complete and such detailed, clear-cut visual imagery as did R., yet the same characteristics are present, even if in lesser degree, in every instance of visual imagery of this peculiarly conformable type. See, for example, that of Fs. below, (p. 275) where the

Indians solemnly shake hands to the rhythm of the music, and where the visual imagery of the Indians on a stage gives place, at a change in the music, to a scene in a stock exchange; or those of V., where a procession in the street changes to a procession of priests in a church,—a transformation suggested, evidently, by chords in the music which suggested the pipe-organ; but both scenes are processions ('the march *Takt*'). There is, however, a vast individual difference in observers as to the number and character of the movements suggested by the music, which are carried over into the visual imagery, *e. g.*, one observer often had no other movement in the visual image than the swaying of a field of wheat, of a tree, etc.

The mood which suffuses this imagery is also of interest. If the music is gay, the visual imagery portrays a gay scene; if the music is a solemn and stately march, the visual imagery has the same character. The expression of the faces usually portrays the dominant or changing moods,—'Girls were so happy,' 'The man was very sad; I could see it in his face.' One auditor insists that this is always *her own* feeling, and that the mood is the result of the music. The visual imagery also frequently portrays the change or movement of feeling in the dimension excitement-repose; *e. g.*, Fs. had a visual image of a group of men waving their hats and selling stocks. 'I never saw a stock exchange, but I was much excited; I could see the excited faces.' R., while listening to a cello solo, visualized a man who was singing 'with more and more feeling.' Instances of such induced feelings and moods are of frequent occurrence in our introspections.

Finally, it should be clearly borne in mind that this visual imagery is entirely involuntary. Observers unite in disclaiming any attempt at trying to invent a story that will fit the music or that will explain the music. Their attitude is rather one of curiosity as to what is going to happen; occasionally incongruities appear which cannot be explained, as for example, 'I cannot imagine why people should dance to such music;' another was much surprised to see lions in a political parade. When asked for an explanation she concluded that the presence of the lions was due to a phrase in the music which might have suggested the roaring of lions.

The observer is often unable to recall any previous experience which will explain the form or content of his imagery. There are exceptions, however, as when one observer reports, 'Music always suggests things I read about as a child; I visualize childhood stories.' In one of the preliminary ex-

periments an observer saw a procession of men dressed in Greek costumes marching in a grove. He added that while a boy he had been extremely fond of stories of the Greeks. On the other hand, another observer visualized city streets, buildings, interiors, individuals and situations she had never seen before. It should be remembered however that she never created an impossible or incongruous situation; and that the details of her pictures were either similar to those of common occurrence or could be accounted for in her previous experience.

Visual imagery seems to be entirely unnecessary so far as the enjoyment of music is concerned. Occasionally an auditor reports that some feature of the image had an interest *per se*; but on the whole they agree that the music occupies the focus of attention and that the image is accessory. On the other hand, there is always the possibility that the possession of such concrete imagery may give definiteness to an experience that might otherwise be vague and abstract. Concerning this, however, our observers were unable to give an opinion.

How are we to account for the arousal of these images which are characteristic of the music consciousness of certain observers? They are apparently sporadic and oftentimes irrelevant; yet it cannot be denied that in certain individuals they contribute to the enjoyment of music.

Wallaschek (127; 120 f.) and MacDougall (137) are the only writers who have attempted to explain the origin of this imagery, although several investigators,—Gilman (130), Downey (128), Lahy (131), Pilo (126).—have reported the presence of imagery which is wholly analogous with that of our observers. Wallaschek refers the phenomenon to the alleged existence of a visual type in music which is comparable with the visual type in ideation in general. MacDougall has recourse to the traditional laws of association,—contiguity, resemblance, emotional congruity. The phenomenon of colored hearing has also been appealed to; but this factor can be operative only in exceptional cases.

The introspections of our observers show that the 'movement' in the musical composition is the essential factor in determining what is the character of the visual imagery that shall be aroused. We have invariably found a most remarkable parallelism and congruity between the variations in the 'pace,' the pitch and the rhythm of the music on the one hand, and the movements of the visualized objects on the other. And this parallelism is no less evident in connection with the general form or the larger unities of the musical composition.

We are convinced that the traditional laws of association are powerless to explain the visual imagery which our introspections have revealed. Numerous introspections which shall be quoted in detail (p. 268) leave no room for doubt that movements,—real or imaginal,—in the body of the observer himself, are correlated with the objective movements of the music; and there seems every reason to believe that these bodily movements determine the direction and the general character of the visual imagery. It must, however, be added that mood (emotional congruity) also plays a part here. But the mood is so intimately related with the 'activity' of the music that the former seems to be a product of the latter. The significance of this factor has been emphasized by the advocates of *Einfühlung*, in its various aspects, and *Nachahmung*, to which we shall recur later.

B. Auditory Imagery

Auditory imagery was reported much less frequently than visual imagery. This may mean either that auditory images were really less frequently present, or that the presence of an objective auditory stimulus constituted relatively unfavorable conditions for the detection of auditory images. In other words, the more intensive,—perceived,—datum may have obscured and swamped the less intensive,—imaginal,—datum. However that may be, it was discovered that those of our observers whose auditory imagery is normally weak and ill-defined tended to report motor imagery during the act of listening to the music.

Four of our eight observers wholly failed to discover the presence of a single auditory image during the whole series of experiments. In the case of the other four observers the auditory images varied in frequency and in significance between extreme limits. One observer reported that their appearance was rare and sporadic; another reported that they were invariably present, usually in great profusion; and the findings of the other two observers fit in between these two extremes. In one observer the essential content of consciousness consisted almost exclusively of auditory imagery; his procedure throughout consisted in "playing with his tonal imagery,"—in recalling the notes which had just been heard and in anticipating the notes which would follow,—both in auditory terms.

Obs. Fñ.—'I 'thought' the music; the imagery was vague and subtle; auditory images, with perhaps innervation of throat; I anticipated the sounds before they actually came; when I anticipated correctly, it

added to my pleasure. During the interlude I had an auditory image of the figure played by the first violin, and also of a bass accompaniment; the latter I may have sung, the former was too high for me.' 'The first four tones of the same pitch led me to anticipate that something different must follow. These four were all in consciousness at the same time, as were also the two tones which followed,—auditory imagery throughout; at the end of the sixth note, a feeling of pause with expectancy, a comma as it were; the remainder of the phrase is in apposition; the second half is similar to the first, but I could not analyze the similarity. From here on, I noticed many variations of the original theme; the similarity was there, but the composition was too unfamiliar for me to analyze; I cannot say wherein the similarity or difference consisted; my difficulty here, I feel sure, is due to the fact that I cannot recall; I cannot hold the variation together to compare it with the original theme; I no longer remember the notes which are just passed; I was conscious of no innervation of the throat; but I cannot now call up the theme without vocal movements. I had difficulty with the first of the two abrupt pauses in the composition; I went on with my auditory imagery while the music held, and it all disturbed me; at the second hold, I paused; I had a vocal motor image of "I should have known better," and smiled when I remembered that as a child I had sung through a pause in just this way. During this time, the music passed out of the focus of consciousness for a few bars; indeed, my attention fluctuated several times in this fashion; there is much pleasure in the recognition of the transformed *motifs*. It frequently happens that several tones have come before I catch their relation to the original theme.'

'About twelve measures after the interlude I enjoyed the entrance of the tenor of the harmony a third above the air but a variation. I hummed the tenor part at first, then I began to predict the next note; this was auditory imagery; I did not have time to vocalize. I just listened, anticipated, compared. All this was in auditory imagery. I had no other thought than the music itself. I listened, compared phrases, expected what was coming, all in auditory imagery, but when the cello came I could not help vocalizing. I made no noise but felt the strain. I thought the cello part was fine; it was such a good contrast. Then my mind drifted away. Near the end I noticed particularly the sequences. I knew that the composition was working up to the end,—to the climax. Often throughout I predicted what was coming. I call up in auditory images what I have just heard. I measure the duration of each tone and compare each tone with the other.' (See also p. 287.)

Any attempt to interpret these findings leads us at once to a discussion of such questions as the perception and the recognition of motives, harmonies, melodies, etc., the analytic attitude of the auditor, the basis of auditory memory, and the like. And while we can not hope to furnish a final solution of these much vexed questions, it does seem that our findings throw light upon these problems.

Inasmuch as all of our observers had had a life-long experience of Occidental music, their attitude toward musical compositions had already become a highly complex, a definitely established and a deeply-rooted product. For this

reason it was obviously impossible for us to hark back to primitive and pre-experiential conditions; in consequence we have been unable to trace out the genesis and development of such complex perception of melody and harmony in so far as that perception involves tonal relationships, consonance and dissonance.⁸

The art of music demands that successions of sounds must be apprehended as groups; and the ability to apprehend successive stimuli as groups presupposes the ability to retain in consciousness, or to recall to consciousness, those elements of the group which have already been heard, i.e., a *sine qua non* of the rhythmic group is that the first element should not be lost to consciousness before the last appears. It is obvious then that auditory imagery may be of distinct service in the appreciation and enjoyment of music. It is of course not our purpose to raise the question as to whether auditory or indeed other imagery is indispensable to the appreciation of music; the question of the indispensability of the image in such functions as perception and recognition has already been answered by psychology in the negative. Yet the function of the image in difficult and non-mechanized recognitions need scarcely be mentioned. Nor does it seem necessary to show that the auditor who possesses a profusion of auditory imagery will *ipso facto* be better qualified not only to detect the recurrence of *motifs*, but also to appreciate the composer's modifications and exploitations of his original *motifs*. It is of course true that the auditor who is characterized by a dearth of auditory imagery may have recourse to indirect means,—to surrogate imagery or to certain other make-shifts.

Those of our observers who reported no auditory imagery were yet able to recognize melodies, and to detect the re-entrance of *motifs* and phrases. Their procedure was of several typically different sorts. One observer adopted the expedient of visualizing the pitch-outline in graphic form. Others made use of their motor reactions; they either imagined or executed movements which conformed to the accentual relationships of the *motif* or the theme. Still others employed the emotional tone,—the plaintive, weird or joyous character,—of the *motif* as a criterion for recognition. But these are, after all, indirect means for the accomplishment of

⁸ The reader who is interested in these problems is referred, for a general treatment, to Titchener (52; 360), and for a more detailed discussion, to Lipps (14, 450), Stumpf (48, 49), Wundt (53; 138), Max Meyer (47, 456), Lalo (11, 184), Bingham (45), etc.

an end; and the composer's development of his theme proceeds in such subtle fashion that its minuteness of structural detail cannot be perceived by the auditor who has grasped but a single feature of the original *motif*. It is, in our opinion, not merely a remarkable coincidence that the observer who was characterized by the greatest facility in the use of auditory imagery was also characterized by the keenest capacity to apprehend the structure and significance of musical compositions.

Our introspections show, however, that a profusion of auditory imagery is not the sole essential for the appreciation of musical compositions. And the very fact that the attitude and procedure of our several observers manifested such typical individual variations as they did, threw the function of the various component processes into high relief and thereby facilitated our work of analysis. These several attitudes and procedures may be represented as series of increasing degrees of intellectual analysis. In those cases where the analytic characteristic was present in least degree, attention was always claimed by some other feature of the composition or its emotional or associative constellations. The observer in whom the analytical attitude was habitually present in high degree was found to assume a wholly different attitude when for any reason the composition failed to furnish an interesting problem or situation for analysis. For instance, a burlesque upon a popular melody soon ceased to claim his attention; and he wandered off to an irrelevant train of associations. But these observers reported that such an attitude was present only in exceptional cases,—when the composition was inherently mediocre or when it was so novel and complex that its significance could not be grasped, and the auditor abandoned all hope of successful analysis. On the other hand, certain observers habitually assumed an attitude in which the analytic function played a minor rôle; here the emotions and the play of uncontrolled imagery were in the ascendant.

It is clear that the musical phrase must not transcend the limits of the span of attention since the phrase must be apprehended as a unit, although it is itself composed of a number of measures. And it is equally clear that practice and familiarity with musical materials must serve to facilitate the task of the auditor in whom the intellectual attitude is habitual and typical. When a musician listens to a musical composition he has in his mind a mass of material, which constitutes a criterion by reference to which the composition

is to be interpreted. He knows the laws of melody, of counterpoint, the construction and progression of chords; every tone of the melody, every chord in the harmony has a name which is of service in its recognition; he knows the musical forms,—fugue, sonata, rondo, and as soon as the form is recognized, he knows further what to expect. Moreover he is acquainted with every means to which the composer has recourse for the furtherance of his musical thought,—augmentation, diminution, transposition, inversion. All of these technical devices become symbolized, as it were. The concrete auditory image upon which all his experience is based tends to drop out and the symbols take its place. The whole mental process becomes complex. All previous experience, education, environment, mental type, go to form the general attitude, the *Einstellung*, which the individual brings to the enjoyment of music.⁴

C. Motor Reactions, Actual or Imaged

Bodily movements, actual or merely imaged, were reported by all observers save one, and she invariably reported visual images which were themselves full of movement. An analysis of the introspective material shows a motor reaction to the rhythm of the measure, a motor reaction to the rhythm of the group or of the phrase, and certain correlations between muscular movement and tempo (rate of speed). One of the interesting problems resulting from the study of this material is the correlation between the objective movements suggested by the music and imaged or actual movements executed

⁴ In addition to the intellectual attitude which is described here, and to the emotional attitude which will be discussed later, it seems possible to differentiate certain other typical attitudes in listening to music. Gehring (22; 49 ff), Norton (125; 190), and others have described the 'symbolic' or 'idealistic' attitude. This *Einstellung* is represented in those auditors who regard musical compositions as an expression, in symbolic language, of human emotions and activities. For instance, musical discords are symbolic of human discords, the complexities of musical structure symbolize human conflicts. The musician who seeks to discover in the compositions of any period an expression of the dignity and stateliness of that period, or of the social unrest of the period belongs to this type. But no representative of this type was found among our observers. We did however discover a variant from the purely intellectual type. The typical procedure of this observer consisted in conceiving the phrases as question and answer, as statement and repartee, as interjection, as amplification, and the like. The music took on the character of a conversation; the first phrase began to tell a story, the second phrase interrupted with an interjection; then the third phrase continued the recital only to be interrupted by further interjections from the fourth phrase, etc.

by the listener. In this connection we shall offer some introspections showing a motor reaction to changes in pitch and intensity, a kinaesthetic localization and seriation of tones in space, and the suggestion of approach and recession in consequence of changes in intensity.

a. *Reaction to Takt.*⁵ Motor reactions to the rhythm of the measure are illustrated by the following excerpts from our introspections:

Fn. 'I felt a strong tendency to move my head with the music.' 'I noticed a tendency to keep time with my foot; my foot stopped when the music held.' V. 'A tendency to move my eyes rhythmically; my eyes are inflamed so that I can feel the pull of the eyeball.' H. 'I noticed the motor sensations throughout,—in hands, fingers, head, upper arm. Near the close I thought of a waltz and had slight innervations in upper leg.' 'Found myself keeping time with my teeth; transferred it to biceps, then to my toe.' Fs. 'I marked time all the way through except at cadenza.' 'I marked the rhythm with both feet; one foot marked the first beat of each measure, the other foot the remaining three beats. There were also slight innervations in the left hand.' 'The whole thing was full of movement; a flashing visual image of the experimenter beating time, of a band master, his whole body alive, tense and alert, muscular sensations of dancing myself. I beat the time with right hand, with both feet at times, at other times with only one. A more decided kick with accented notes.'

Introspections follow showing a tendency to execute movements of swaying and swinging with the music; this movement was not in unison with the *Takt* but was in accordance with the first accented member of the group, or with the larger rhythm of the phrase.

Fn. 'I swayed, felt as if the whole body were breathing' (this to the phrases). 'My head rested on my left hand; my fingers were over my eye-brows; when the melody began, my pulse throbbed; I felt a swaying; I could not listen to the music and inhibit my movements.' W. 'I caught myself breathing in exact time with the phrases.' H. 'I felt as if my whole body moved with the swells, like the swinging of the bow of the violin.' S. 'The rhythm became apparent as the music began; I seemed to swing right into it; I had no tendency to keep time with foot or hands; the thing was in my whole body, hardly perceptible.' Fs. 'I experienced a distinct motor image of my arm moving.' 'I got a motor image of two-stepping; I seemed to feel myself dancing.' W. 'Felt as if I were being rocked in a cradle.' V. 'I was conscious of a feeling of rhythm, of swaying like a wash of water.' 'I felt as if there was a movement inside of me, something moving to the rhythm of the music. It is like a sensation of strain, first on one side and then on the other.'

It is significant that in no case did an observer become conscious of the rhythmic experience without experiencing either

⁵ The writer has failed to find a sufficiently definite equivalent for the German *Takt*; and this term will be employed throughout to indicate the measure, or the rhythmic beats within the group.

actual or imaged movements. Not infrequently observers report a conviction that there are movements which could not be localized; in the case quoted above the observer thought she would not have detected the pull of the eyeball in rhythm had her eye not been hyperaesthetic. When actual movements were inhibited one of three things usually occurred. In some cases the rhythmic effect was decreased; in others a tendency to movement appeared in some other part of the body; or, again a motor image or a visual image served as a substitute for the actual movement. In one case after successively moving head, fingers, hand, foot and entire body to the rhythm the observer began to whistle (silently); he found that this action served vicariously for the others; when the whistling was inhibited the hand began again. Occasionally, also, an observer reported that the respiration followed the rhythm of the music; this however is not frequent or long continued since the rate of respiration is too slow for the rhythmic beat of the measure.

This bodily movement to the *Takt* is most evident while listening to compositions in which the rhythmic element is predominant as *e. g.*, the march or dance; and is again stronger in two or four *Takt* than in others. In the waltz often the first beat only is marked, though the second and third beats are frequently marked by individuals who perform music or who dance. In other compositions where the rhythm is less prominent, the motor reaction is usually only to the first accented member of the group or the larger movement of the phrase. The motor reaction to individual notes will be discussed later.

There is, of course, nothing novel in our discovery of a bodily reaction to rhythm. Parry has pointed out that to mediaeval composers rhythm represented physical action, the attribute of the physical body and was, therefore, secular. And while the earlier experimental investigators of rhythm were disposed to postulate a central rather than a peripheral theory of rhythm, most, if not all, of the more recent experimentalists hold that the perception of rhythm is completely dependent upon the presence of kinaesthesia. We do not feel justified in urging our results as a contribution to this general problem since in music there are other factors which cannot be dissociated from the pure rhythmic experience, *e. g.*, bodily reactions to changes in pitch and intensity, associations with march or dance, emotional factor, etc., not to mention the various factors long since pointed out by Meumann. However, our introspections do substantiate a further

distinction made by Meumann (65; 317-319), namely, the difference between the perception of rhythm and the perception of *Takt*. Three of our auditors were never aware of any *Takt* except that of march or waltz; they were always aware of rhythm. For these auditors rhythm is not objective, something in the music, it is subjective, a feeling of their own activity. On the other hand, those auditors who habitually listen to music intellectually always perceive *Takt* in addition to the perception of the rhythm.

b. Reactions to Larger Rhythms. Certain writers, Parry (27; 198ff.), Glyn (78; 192), Bolton (60; 22, 26), Wundt (73; 154), Riemann (28; 33ff.) and others, have discussed larger rhythms in music which are formed by the combining of several groups into a phrase, several phrases into a section or period, several sections or periods into a 'movement,' and finally several movements into a cycle. In the rhythmical idea also is seen the principle of 'contrast,' of 'variety in unity,' the laws of ternary and binary forms, the swing of the tonic harmony to dominant and back again. No attempts have been made to correlate any of these rhythms, except the phrase, with organic or muscular movements. These Riemann has attempted to correlate with respiration,—a correlation which, as we have seen (p. 252) we have been able to establish under certain conditions by an appeal to the kymographic records. We have also reported introspections from six of our eight observers who found larger muscular movements or images which corresponded not to the *Takt* rhythm but to a larger rhythm which we have identified as that of the musical phrases. It will be noticed that the typical experience was a motor image of swinging or swaying.

While it is quite possible that the musical phrases may be distinguished from one another by cadences, and therefore may be differentiated from one another, we are inclined to believe, after a careful study of all the evidence, that the feeling of these larger rhythms is conditioned either by actual movements or by kinaesthetic images. In fact, whenever a composer relies upon rhythm to produce a desired effect, the realization of that effect by the listener is dependent upon the appropriate motor reaction, either in the form of actual, implied or imaged movements.

c. Correlation between Muscular Movement and Tempo. The tempos of the various compositions employed in this experiment were kept absolutely constant; hence the effect of a change in tempo in successive reproductions of any one composition could not be observed. Occasionally, however,

an observer reported that a tempo seemed to be too fast. The reasons given in the introspections are as follows:

V. 'I followed the rapid little places (Herbert's *Badinage*) on my toes. In the slower parts I had a tendency to hold muscles with some suspense waiting for the rapid passages. The music did not please me because it was fatiguing to remain so long on my toes.' Again, 'I had strains all over the body in the first part. The rate was too quick for me; the time of the movement is too fast for me to react to. It is a delicate dance for a person too large, so I found it unpleasant.' Fs. 'I had motor imagery of waltzing, though the time was too fast for a good waltz.' S. 'When the music goes so fast, it is not particularly pleasant. There is a feeling that the performers will not be able to carry it through; that they will break down.'

The reaction of V. to the *Badinage* is of much interest in this connection. The composition, which may be characterized as an alternation of slow and rapid passages, was repeated after a month's interval. In both hearings her reaction was the same. At the close of her introspections, some questions were asked; they with their answers are as follows:

(Do you like fast dances?) Yes, if they are strong and vigorous, but I do not like little dainty fast dancing. (Do you think if you had imaged a fairy as making the rapid steps the music would have pleased you?) I think it would; to me the music was coquettish, I was not in that mood, I did not want to go fast.

All of the other observers enjoyed the rapid passages in this particular composition. One observer imaged young girls as making the movements; another visualized a fitting butterfly; still another 'vaguely projected the rapid little movements in space' (probably eye-movements). The reaction of another was vocal-motor.

In discussing the relation of heart-beat to tempo, we found that a number of authors had fallen upon the normal rate of heart-beat as the criterion between fastness and slowness. (See p. 253.) Since an appeal to the kymographic records shows an increase in the rate of heart-beat for all tempos, and since no correlation between tempos and concomitant rates of heart-beat could be found, we do not feel that this theory can be sustained. The introspections above show why, for some of our observers, the music was too fast. They are three: (1) The music was too fast for the particular motor reaction which seemed most natural for the observer; (2) The music was too fast to be danced; (3) The music seemed to be too rapid for the musicians. To these, other obvious reasons might be added. Musicians know that notes in diatonic succession (scale passages) may succeed one another more rapidly than the succession in larger intervals. This might well be

explained on a motor basis but it is possible that the inherent laws of pure melody may be a determining factor. Again there is the factor of contrast; a tempo of 80 may seem fast after a tempo of 60, or slow after a tempo of 120. Ebbard's experiments seem to show that the introduction either of an emotional element or of additional stimuli may cause the performer to quicken the tempo without being aware of the acceleration. And our experiments have shown that the auditor's judgment of the tempo is equally subject to variation. The human body is not equipped with a physiological metronome, by means of which tempos are estimated in any constant fashion. The only criterion of tempo which we employ is an indefinite 'sense of fitness' whose estimate may vary from time to time without any concomitant variation of heart-rate, of respiration or of other physiological process. And we estimate tempo in terms of our momentary ability to make that motor response which seems to be most fitting for the particular composition which constitutes our stimulus.

d. Correlations between Objective Movements suggested by the Music and Actual or Imaged Movements on the part of the Listener. Aside from the motor reactions which we have correlated with the various phenomena of rhythm, there are movements, or tendencies to movement, with each successive tone. The most frequent evidences of these are the mimetic movements of singing or playing. These, however, will be discussed in a later connection. Only those muscular movements which accompany each tone will be discussed here. The tendency noted above to follow the rapid places on the toes is a case in point. Another auditor says 'I anticipated to see whether the note would go up or down. I think there is a tendency to accompany this with the whole body; to ride with it.' 'I noticed that my eye brows went up when the music went up.' 'I got clear visual imagery of a stage, a motor image went up and down.' The visual imagery is full of such movements, the flitting of a butterfly, the various and intricate steps of dancers. We have above noted a case where the dancers jumped at a sudden rise in pitch of the music. On another occasion the same observer said, 'Two Gipsy girls were dancing, making very rapid movements, like flying.'

In our review of the literature we noted the experiments of Féré (94), Tarchanoff (119) and Scripture (118), which seemed to show a correlation between changes in pitch and contraction in muscle. This correlation seems to be generally accepted. Our introspections serve only to show how consciousness is affected by these muscular contractions. Gurney

(23; 140) raises the objection that the succession of sounds in music is often so rapid that a muscular reaction to each sound is impossible. The motor reaction, however, does not imply a complete contraction and relaxation for each sound, but only a partial contraction or relaxation. For example, in an ascending scale passage the contraction might continue from the lowest to the highest note. The apparatus used in our experiment was not devised to record these muscular movements so that we cannot present any objective data concerning them. From a study of the introspections we are forced to the conclusion that whenever musical movement becomes objectified some corresponding muscular movement takes place in the body of the listener. We are of the opinion that eye-movements function largely in the result. The following introspections have a bearing on this general problem:

Pitch.—Fn. says: 'I localize the up and down of music in space; this without visual imagery—it is manual-motor. V. says: 'My first impression of a low note is that it is away off to the left, high note to the right. If a note is prolonged it changes its position in space perpendicularly. When the dentist is working on my teeth there are two kinds of pain—one front, one back. The former has often been associated with me as a high, shrill note, the latter as a low bass note. Yesterday, I bit on something that brought up the back pain: immediately the idea of the bass note came—the auditory image first, then the visual image of the key board.' This she thinks may have come from a childhood association: when suffering with neuralgia her cousin tormented her by thumping on the piano. S. says: 'When music goes up and down, it seems like a stairway. When it goes down three or four notes in succession, I seem to be swinging with it in steps. I think I remember music in that way.' C. says: 'Near the end, I anticipated the notes ahead; it may have been partly auditory but I think it may have been a fusion of auditory-motor. May have been visual—a feeling of steps in two dimensions of space.' R. says: 'When the note went high, a girl who was standing in the middle of the room suddenly raised her arms up high.' (This a visual image.)^{*}

The case of S. which is cited above is of particular interest. At the close of the experiment he drew diagrams of ascending and descending scales. These were ascending and descending steps; the width of each step is relatively determined by the duration of each tone. These steps are localized in space in purely motor fashion but without any visual imagery. His report that his memory of music is of exclusively motor-spatial character suggests a similar case which has been cited by Wallaschek (127; 126). Squire (69;

^{*}The reader will observe that certain of these spatial localizations which are here discussed under the general heading of motor imagery are visual and not motor: for reasons of economy of space it has seemed wise to discuss spatial localization of whatever sort at this point.

558) reports introspections wholly analogous with ours. "The associations were very frequently of a spatial character; high was 'nearer,' low was 'further away.' Low was 'big' and high was 'thin.' One subject spoke of the high tone as a 'silly little appendage,' another placed the high tone in the top of the head, the other at the base of the skull, and experienced a flipping from the one position to the other as the tone changed." These introspections are quoted here to show that, whether or not from associations, some individuals do objectify tones of varying pitch in space.

The question has often been raised as to the reason why pitches are designated as high and low. The answers are many and varied. This peculiar mode of designating pitches has been referred to the corresponding degrees of tenseness of muscle (Sully, 33, 272; Steinitzer, 19, 18; Combarieu, 20, 128); to corresponding regions of the human body (Goblot, 136); to corresponding positions on the musical staff (Souriau, 18, 305); to corresponding differences of mass, weight and volume (Gurney, 23, 140); to corresponding differences of quality (Stumpf, 50, 189ff.); and to a purely arbitrary origin (Bellermann, See 18, 19). The introspections of our observers show that tones are ordinarily externalized and localized in space, that they are assigned to high or low altitudes in space corresponding to their high or low pitches, and that this process of externalization and localization is characterized by its immediacy and unreflectiveness. This perception usually assumed a graphic form (manual-motor) or a stairway form (visual; pedal-motor). But our auditors have thrown no light upon the means by which they came to perceive pitches in this fashion.

Musicians have themselves recognized the intimate relation between movement and music. They have stated that their art is concerned with rest and motion,—or, as Riemann (28; 1) puts it, with rest, motion and rest. Köstlin, quoted by Gross (8; 21f.), states that music glides, turns, hops, leaps, jumps, dances, sways, quivers, blusters, and storms, and adds that the auditor who adequately reproduced its movements in the physical world must become imponderable or he would be dashed to pieces. But, as Gurney has pointed out, the essential characteristic of music is an 'ideal motion,' not a physical movement. It is evident that the term 'motion' is here employed in two senses, the one objective, spatial; the other subjective; but both depend primarily upon the same factors,—changes in pitch, intensity, duration, and rhythm. The 'ideal motion' of Gurney seems to be a product of two factors,—a motion due to expectation and satisfaction, and a movement of feeling (see pp. 279ff.); and this conception of music may be a purely auditory experience without any objective reference. Our introspections show, however, that for certain individuals the ideal motion is objectified and ex-

ternalized. The music arouses bodily movements corresponding to changes in pitch, intensity, speed, and rhythm; and it is the bodily movements which, we are convinced, are in turn objectified.

e. Other Mimetic Movements. In addition to the sorts of motor reaction which we have described, there are other tendencies to movement which are not directly connected with the rhythmic or other movement factors which are inherent in the music itself. The first of these is the tendency to hum, to sing or to whistle the melody. This reaction to the music gives expression in some instances to pent-up feeling; it is analogous with an audience's expression of its enthusiasm by means of applause.

Fn. 'When the cello came, I had to vocalize; no noise, but felt a strain.' 'I found my throat moving, singing the music. I felt the strain there.' Fs. 'I had a tendency to sing at times, a weak innervation.' 'I had a clear vocal-motor image of singing with her, a tendency to smile with pleasure.' H. 'I wanted to sing the melody. I thought I could not sing the high notes, so dropped to the baritone.' 'Head, arms, legs, fingers, all my body got into it. Soon I began to whistle the tune; this required more attention and legs, arms, etc., stopped as if satisfied.' 'At one time it attracted me enough to make me whistle.' 'I always want to whistle or to sing, no matter what the music. I enjoy music more out of doors than inside because I can sing and whistle.' V. 'In one place I felt my tongue move as if I were going to sing the music.'

This motor reaction appears in another form in those observers who play some instrument. They feel their arms or fingers make the playing movements.

Fn. 'I caught myself bowing my violin with the music.' 'I could feel the pull of the bow, the fingers moving.' 'I felt as if I were trying to play it myself.' Fs. 'I found that my left hand was executing the movements of the right hand playing; kinaesthetic image of playing the violin; the left hand bowed at times.' 'I had a motor image of playing; I could feel the glides and tremulo vividly. I felt as though I were playing the accompaniment on the piano, and trying to keep in unison with the orchestra.' 'I had innervations of playing, in my left hand; I was not aware of my right hand.' 'At low notes I felt myself playing; I knew that they were difficult to play.'

In the introspections of Fs., the images of playing were always confined to the left hand; they were never referred to the right hand, which was in the plethysmograph. In one case, her left hand played the treble part of the keyboard, which ordinarily would fall to the lot of the right, and yet the introspections show that she was not conscious of her right hand; *i. e.*, this interesting phenomenon seems to be a product of *Einstellung*; there was no trace of a conscious

and voluntary inhibition of right-hand movements, or of conscious and voluntary transfer of these motor images or incipient innervations from the appropriate but imprisoned right arm to the inappropriate but free left arm.

The introspections of certain observers reveal the presence of involuntary movements, which apparently are connected neither with the movement of the music nor with mimetic expression, but were more like muscular twitchings which the observer could easily inhibit. The plethysmographic tracings of two observers revealed involuntary movements of which the observers were not conscious.

f. Motor Phenomena of Expectation and Satisfaction. Invariably our observers, reported respiratory and other motor concomitants of expectation and satisfaction. It is probable that expectation is present more frequently, though in a less degree, in the case of the hearer who follows the music analytically; but it is also found in the case of those auditors who listen more passively. So long as the rhythmic or melodic flow is uninterrupted, the attention of the hearer tends to be more passive. But if the rhythmic flow is interrupted, if a sudden dissonance enters, if a 'pause' or cadenza is inserted, attention at once becomes alert; and those bodily processes which are under voluntary control are instantly arrested. When the melodic movement recurs, both the mental and bodily processes flow on again. The same phenomena of interruptions and resumptions frequently accompany the hearing of the final cadence of the composition.

Fn. 'I enjoyed the flute cadenza; a feeling of suspense; I felt my whole organism pausing for a moment; the normal flow began again after the first note of the cadenza.' 'The expectancy contained, as one of its components, an auditory image of the forthcoming chord; this has happened frequently but with different degrees of clearness.' Fs. 'I held my breath, and turned my head to listen better.' 'I was aware of holding my breath just before the last movement where the cello holds.' 'Visual image of theatre just before the curtain goes up,—expectation. I was in the orchestra; as the intensity of the music increased, I could see pianist and conductor; saw the lamp flash for the curtain; my feeling of expectation was strong. I think this was due to the music itself, but I am not sure as to how much belonged to the music and how much to the image.' 'Tension throughout; it was hard to localize; lips were parted; felt a tendency to smile; a feeling of stilted breathing; close attention in the long cadenza; held my breath; a feeling of expectancy.' 'There was a feeling of climax about the middle where the six major chords merge into the four minor chords; decided expectancy with intensive tension.' 'A feeling that the end of the phrase was coming. This was partly due to familiarity; slight tension gathered with the phrase: a vocal motor of 'wha—' (what) accompanied by slight facial tension. This was the way in which the question, in the expectancy, presented itself.' H. 'With the

holds, I held, and I pulled up to them.' V. 'Noticed a tendency to keep time with the foot but my foot stopped when the music held; I noticed a tension as we approached the final cadence.'

The following introspections are cited to throw light upon the basis and the constitution of the experience of expectation; many others of analogous import could be added.

Fn. 'I knew the end was coming; thought it was fine; it let me down so easily.' (How did you know the end was coming?) 'From the characteristic sequence of tones. It may be due in part to a memory of other compositions. I cannot always predict; it sometimes stops abruptly.' 'I knew the end was coming; when I heard the *sol*, I knew that the *do* was coming. When the music stopped, I was very quiet and restful and satisfied.' 'After the music, it was quiet, as if the storm had blown over and now all was still.' Fs. 'I knew the music was coming to an end, though I did not look forward to what was coming next.' 'Just before the end, I felt it coming; tensions in my face, foot, heel and toe; my toe would go down on tensions.' 'After the music stopped, an all-is-over feeling as when the curtain goes down; possibly slight relaxation.' 'Was conscious that the music was working up to climax, but I did not work up with it. After the music stopped, I found that I was not tensed in any degree, I could not relax further; the music had scarcely impressed me.' 'Strong feeling of the ending, with regret, because I felt that 'just around the corner' I might recognize it.' (Did you know that the music was coming to an end?) 'Yes.' (How did you know it?) 'There are several stereotyped endings which one can recognize.' V. (Did you know that the music was coming to an end?) 'Yes.' (How did you know?) 'There are certain chords, progressions, that often end compositions.' C. 'I felt that the end was coming; my eye-brows went up; a vague sensation of strain; the sound was in the focal point, the strain in the fringe.' 'At one place I thought the music would cease; I was all attention; thought it would stop; then came a pause—and a feeling of uncertainty; then the music went on again. After this, I felt a settling down as before; a change in muscular feel. When music stops abruptly, I seem to come down with a thud; as it approaches a climax, I rise with it; I get more tense, and then I drop.'

These introspections make no new contribution to the psychology of expectation. They do show however that the experience of expectation is an essential component of musical enjoyment; and they furnish a general confirmation of the recent results which have been yielded from an analytical study of the experience of expectation. The bodily attitude is analogous or identical with that of attention; attention to a mental content is, however, usually lacking. The experience is describable rather as an anticipation, a suspense, or a waiting for what is to come. The attitude assumes different forms and contains different components, in different individuals. In certain individuals the essential content was verbal motor,—an incipient tendency to ask: 'Wha— (what)?' and the like.

Other observers report visual images of persons in an expectant attitude. Others, an auditory image of the expected tones or chords.

D. Reactions to Descriptive Music

As has been indicated in our summary of the literature, musicians and aestheticians in general have frequently concerned themselves with this question: To what extent may musical compositions be employed as a vehicle for communication and expression? Can the composer or conductor hope by means of his art to convey a definite idea, such as a story or the description of an incident, to his auditor?

We attempted to throw light upon this problem by means of a 'descriptive' composition. This descriptive selection (*Voelker*, Hunt in the Black Forest) was an orchestral record. The program or legend which was supplied by the publishers indicated that the selection portrayed the following incidents: the break of day; the birds sing in the forest; chanticleer's voice; the huntsman's horn; the village chimes are heard; the hunters assemble; they start in full gallop; the horns sound the halt; at the forest blacksmith shop; the smith at work; they start again; the hounds scent the game; in full cry; the game is run to earth; cheers; *finale*. The title of the selection and the descriptive legend were of course withheld from the auditors; they were simply asked to listen to the music and subsequently to report their experiences. The following are the introspections.

Fn. "At the outset I concluded that it was a 'barn-yard' selection; then I paid no attention to it although I heard the sounds throughout. I wondered how they make the dog bark. Toward the end, I began to analyze; and from there on I rather enjoyed it."

V. "I was puzzled to know what it was all about at first; I thought it was the opening chorus of 'Woodland' (a popular musical comedy). I had a visual image of a stage with the sun coming up; Chanticleer and the birds coming together in chorus; there was much movement and streams of light quivered when the sun came up. Then I went to the circus; this occurred when I decided that it was not 'Woodland.' I saw a saw-dust ring. When the anvil sounded, I saw some object flying around the ring; at the stroke of the anvil this object was in the fovea. It was like swinging a chestnut around on a string; the entire circle you see, but at one place it seems to be more clear; and this place seems to give the impetus for continuing the movement. I noticed a number of animals. After I had seen the animals, etc., I was aware of a muscular tension in my right arm; I tried to relax it slowly. Just before the music ended all the people got up and crowded out; dogs appeared in the distance. Attention was more active than usual; more attention and less mood than in the other experiments. At the instant when the shout came, the audience were rising from their seats. No effort whatever was required to bring up this picture; it just came. I saw horses and dogs running around the ring. It was a circus, and one place was like a galloping horse. The bell (village chimes) in the beginning disturbed and confused me. I inferred that the sun must be going down. It ought to be evening but the sun was not going down; it was coming up; it may have been the twittering birds that suggested the sunrise. The opening scene of 'Woodland' depicted an evening setting. There was something about the crowd and confusion that may have accounted for the tension in the right arm."

Fs. "In the fore-period, I was conscious of intense anticipation. When I heard the cuckoo, it aroused a visual image of a cuckoo clock and a cuckoo whistle; also of a bugle. The minor music aroused an image of Indians; a cheap stage; Indians stealing about the stage; a sensational mock-murder; a fierce grin as if they enjoyed it. Then a moving picture image of Indians. Something sounded familiar; much excitement; the Indians entered again in a row, but instead of coming through the wings they entered from an incline so that I could see first the head, then the shoulders; they had the same fierce grinning expression on their faces; they shook hands in time to the music, lifted their knees high and stamped. A feeling of amusement such as I have had in a badly played melodrama. Visual image of a group of men waving their hats; also men standing above, selling stocks. I never saw a stock exchange, but I was much excited; I could see the excited faces. Suddenly it turned into an auction sale. This was followed by a motor image of a dance where the bones were used in the music. I distinguished the barking of the dogs, around the auction sale; there was still much excitement. As I realized the end was coming, attention decreased rapidly; there was no pleasure as before; I enjoyed it in a totally different way. There was 'something doing' every minute throughout the selection; excitement, complex of muscular strains, verbal imagery, New York Stock Exchange, and a very weak vocal-motor innervation of 'New —,' a verbal image of Bernhardt. (Did you notice the rooster crowing?) Yes; and a vocal image of the word 'rooster.' (Did you notice the church bell?) Yes, decidedly; and had a visual image of a church tower. Toward the last I wondered about the instruments used:—'How in the world did they produce that effect?'—a faint verbal image. After the music stopped the barking dogs made me think of a vaudeville performance which I saw during the vacation; I was bored then and I felt bored here. That feeling vanished with the image; then I smiled and laughed aloud at the ludicrousness of it all."

W. "In the fore-period, I held my breath for a long time. I saw the gypsy scene in *Carmen*. It was dawn; when the bird calls came, I thought of a comic opera called 'Woodland,' in which the actors were all birds. I recalled one of the duets, 'Between a Cold Bottle and a Hot Bird;' then thought of Rostand's Chanticleer and wondered if it were like Woodland. I then went back to *Carmen*, where the stage fills up from the cigarette factory. I had all sorts of motor sensations in my hands, feet, legs, everywhere. There was a queer racket in one place like rolling a hollow box; this took me to an amusement park, on the Coney Island order, where I saw all the shows, etc., particularly 'Shoot the Chutes.' Then the dogs came in, and I went to the circus; there were three rings—trained dogs, horseback riders, etc.,—a complete mix-up until the end, with tendencies to move throughout. I saw clowns in all sorts of costumes and it was they who did the shouting at the end (cheers of huntsmen in *finale*); I also saw riding-masters whipping their horses. The dogs made me think of the bloodhounds chasing Eliza in *Uncle Tom's Cabin*. In my opera picture, no one spoke or sang,—people just moved about on the stage."

R. "When the music first began, I got a picture of a *Plärer Messe*—'shows' of all kinds. In the distance, a church-bell was ringing. Music was playing at one of the 'shows' where the details of a murder were being exhibited; 'spielers' were talking; while moving about, I saw a menagerie and as I passed by I saw snakes, lions and dogs. The bells were still ringing outside; all music stopped except that of

the merry-go-round. I saw a riding school; two men in front noisily announcing their attraction; I went in; there was only a little music. I then went into the menagerie; I saw a woman in light blue velvet who was performing with the lions; she put a ribbon around their necks; then suddenly ran, the lions after her, but she got out. A big dog, always barking, came out and ran about; a man tried to catch him but never succeeded. The chase was amusing. In one place, he nearly caught the dog and everybody yelled; but the dog got away and then everybody laughed."

H. "I could not understand what the music meant; I thought the melody was very queer; I wondered if it were Oriental because there was no rhythm. Then it fell into rhythm, and I realized that it was a descriptive selection. I concluded that somebody was making all this noise intentionally. Just before the dogs began to bark, I realized that it was a hunt. Once in a while, amid all the noise, I could hear the band like a tin pan; however the dogs made so much noise that one could not hear the music well. I lost interest; finally when it stopped, I said 'Bah, any band can do that.' One place attracted me enough to make me whistle for a time. I had some visual imagery of men on horseback galloping over the fields with dogs; of a tally-ho also, with a cheap band down to start them off. It was slightly amusing but it did not appeal to me favorably as a musical composition. It occurred to me that many people would like such mediocre stuff."

S. "The music came gradually and there was more visual imagery than usual. Near the beginning of the selection there were a number of whistled notes (probably suggested by the twittering of the birds). I saw the mouth of the person who was whistling. I heard the tramping of horses, and had a visual image of horses trotting toward me. I felt the increasing tenseness; then as my visual picture disappeared, it seemed to get smaller and smaller,—this because the music became less clear. The noise and din which represented a battle brought some excitement; and I also felt excitement when the horses came trotting up. The images of the battle were more like a picture; the armies were standing, but individuals were moving; near the end, one detachment of the army was falling back. (Did you hear the rooster?) No. (The bells?) Yes, I saw bells, silver bells. (Did you hear a dog barking?) No. (Did you hear any shouting?) Yes. (Did you have an image of it?) Yes, I saw a flag and around it a group of men who were waving their arms. (Did you hear the bugle?) Yes. (Did you notice any tendency to move your body?) No. (Were you conscious of any of that 'dragged feeling' which you reported on former occasions?) No; I followed the picture all the way through. (Can you account for the fact that there were more visual images to-day?) The music was more descriptive. (Why do you say that it was more descriptive?) Some music calls up a scene,—some does not. This does. Perhaps the bugle and the bells helped to bring it; they were fleeting; but the moment I heard the horses, I saw cavalry coming."

A survey of these introspections reveals an enormous individual variation in the mental contents of the several auditors. It is true that several of the introspective descriptions contain elements in common: an outdoor scene; songs of birds; animals; the dawning day; rapid and vigorous action, and the like; but the setting or story into which these elements are interwoven shows a marked difference from in-

dividual to individual. One auditor conceived the music to be a portrayal of a battle; another, of a circus; another, of a melodrama; another, of a hunting scene. It is a remarkable fact that even the purely mimetic descriptions, such as the barking of the dogs, wholly failed in certain instances to arouse situations such as the composer and the conductor had hoped to simulate.

These introspections show that the composer is powerless to evoke any one definite mental picture in the minds of all of his auditors. Music is unquestionably adequate to the task of suggesting definite and particular emotions; and without having recourse to a legend printed upon a program it may even on occasion convey certain ideas and characteristics provided they be of a wholly general sort. But even here neither composer nor conductor can hope, without extrinsic aid, to attain any high degree of definiteness or community in the mental content of the several auditors. Clues to a general situation may be contributed through the medium of tonal imitation, of rhythmic suggestion, and the like; but the associations and the constellations to which these clues give rise are, in great measure, beyond the control of the musical stimulus. Music *per se* is able to give definite expression to no more than activity, storm and stress, varying moods of plot and scene.

E. Emotions and Moods

The emotions which were reported by our observers were of varied nature and of varied origin. In not a single instance was an intensive or a long-continued unpleasantness reported,—a fact which may have been due to our choice of selections, and to the temperaments of our observers. It is a remarkable fact that when a selection failed to arouse pleasantness of any sort in any degree, it became so uninteresting that the auditor's attention wandered to other topics. For instance, the descriptive selection failed to appeal to Fn.; his wandering attention was recalled only when the loud barking of the dogs was heard. And even here his attitude was characterized not by such emotions as music ordinarily arouses, but by a query as to how the imitation was accomplished. The same phenomenon of inattention was reported whenever unpleasantness made its appearance, even if for only a moment. The sources from which musical enjoyment is derivable are so multifarious that one is not surprised to find that indifference and unpleasantness have been so rare and exceptional.

The tones of musical instruments, even when presented in isolation, have a distinct hedonic quality. And in numerous instances our observers reported a sheer delight in the timbre of particular instruments. Chords, resolutions of chords, nuances of tones, and the like, were also sources of enjoyment. To these may be added the characteristic motor reactions to rhythms, to runs and turns, to abrupt contrasts of pitch. The mimetic reactions, such as humming, singing, whistling, beating time, playing the violin, piano, etc., which characterized the procedure of several observers, were also found to be distinctly pleasurable in many instances. Those observers who reported a vivid play of visual imagery frequently testified that they derived keen enjoyment from being spectators of these kaleidoscopic changes. When compositions are so familiar as to be already endowed with a wealth of associative supplementations, these associations may themselves contribute their quota to musical enjoyment,—apart from the fact that this very familiarity enables the auditor to enhance his enjoyment by a successful prediction of how the theme is about to unfold. The various sorts of intellectual appreciation give rise to an enjoyment of their own. For instance, the skilled violinist or pianist derives a peculiar pleasure from a display of skill and technique upon one of these instruments; similarly, the auditor who is trained in the technicalities of musical composition appreciates and enjoys the ingenuity and skill which is manifested in the work of the composer. To these must be added the pleasurable emotion which is derived from an idealistic or symbolic interpretation of musical compositions. Two other factors, which we shall call mood, and excitement-repose, are so exceedingly significant for musical enjoyment that a more detailed treatment will be accorded to them later.

Fn. 'I like the E flat cornet when it enters high in pitch; it is a fine spot.' 'Enjoyed every *crescendo*, the nuances were brought out so well.' H. 'I noticed that the music was a cello solo with piano accompaniment; enjoyed the richness of the tones, the high notes of the piano were so clear, felt intellectually that the music was of high order.' Fs. 'The harmony of the first movement was pure pleasantness. No mood. I also enjoyed the tone quality of the oboes.' 'Two long notes in the introduction were decidedly pleasant, they were so exquisitely played.'

V. 'Felt as if I were on the shore watching some reed or plant rise and fall on the water; a vague and dreamy pleasure.' 'The rhythm was so irregular it interfered with my pleasure, I could not dream as I wanted to.' R. 'I never heard the music before but it was beautiful and the dance (visual image) was beautiful. I enjoyed the figures of the dance very much.'

Fn. 'In the fore-period, I recognized it by name and thought it was fine.' 'I used to sing it in the glee club; this morning I tried to sing it but could not recall the words. The boys and the accompanist came as a visual image,—all this during the first two strains. The reaction was essentially emotional, such as old friends bring up when you meet them again.' 'Degree of attention was about that which is usually present when one hears a new composition. I was passive,—a good deal of it escaped me; I could not follow it as I would a familiar selection.' 'My memory of the music gives me an additional pleasure. I analyzed, anticipated phrases, but I knew the selection and did not have to work.' 'The composition was new, I found that it required an effort.' Fs. 'The music came and was immediately recognized. I play it. It was distinctly pleasant; I had a feeling of being master of the situation because I knew what was coming.' C. 'I always enjoy music better after I have heard it. Occasionally, if it is decidedly lyric, I enjoy it as much at first.'

Fn. 'Where the notes are highest and most intensive, I have a feeling of excitement which subsides as the pitch and intensity fall. This has pleasantness as a background.' 'While listening I began to get excited, just as though I was getting ready to laugh; there wasn't any fun in it, just pleasurable.'

Fs. 'I felt a thrill, a decided tendency to smile. There was a slight intake of breath, a tendency to lean forward—a sudden welling up of pleasantness, which suddenly subsided.' Again, 'There was a suspension of rhythm in listening to the cadenza; this was very enjoyable,—accompanied first by decided attention, then relaxation. After this the rhythm came in again.' V. 'Near the end where the heavy chords came I thought of a triumphal anthem, I went along with it.' 'It was exultant, I had a sense of buoyancy, of well-being, my chest felt inflated; I had no tendency to move, but a sense of well-being.'

We have already referred to what seemed to be a movement of feeling, a rise and fall, or an ebb and flow in some such dimension as excitement-repose. The most complete introspections were in consequence of the special instruction to 'attend to the phrases,' though these waves of feeling were reported independently in numerous instances.

Fn. 'The music seemed to be rolling throughout; it worked up to the high notes, then came down not only in pitch but in intensity. Ascending, all is energy; I feel it go up, feel it come down; my own feeling waxes and wanes. This is pleasurable throughout but more than that.' 'I let myself go with the movement and found it more emotional as it went up and down. I got into it on the downward movement. By 'getting into it' I mean I felt it myself. I noticed much kinaesthesia; had sensation in my right arm of moving downward; my arm was quiet but I imaged it as moving down to the right,—moving to a position of rest, accompanied by relaxation. In one instance where a phrase was repeated a third time, I felt the greatest excitement accompanied by a thrill; then the excitement came down to repose. I think 'excitement-repose' would be good terms to express the poles of this feeling. I anticipate the climax before it actually comes and I pull up to it. The excitement is accompanied by some sort of tension; I think I often image this kinaesthesia; at least, I am unaware of actual contraction.'

W. 'There is a decided rise and fall of affective tone; it rose with the climax of the phrase. When the next phrase began there was not so much tenseness. That queer elusive feeling of myself swaying was present about the middle of the composition. At times I seemed to be humming; once I was aware that I was breathing up with the climax of the phrase, and would then start down with it.' 'The rise and fall in feeling was correlated with muscular tension and relaxation. My breathing seemed to be sending the bow (of the violin) up as if the rise in breath was actually motivating the music. I also noticed vague muscular sensations in my limbs, arms, all over the body. Coming down there is a release of tension, a sinking into quiescence; but complete repose is not reached until the end of the composition where there is also a diffused feeling of general satisfaction.'

Fs. 'I noticed slight tension gathering with each phrase; and then, though not always, a relief,—a relaxation at the end of the phrase. I tried to fit up a meaning to the phrases which seemed to be in narrative form; the first phrase makes a statement, the second amplifies, the third is almost the same as the first but with additions. This works up to a climax, with increasing but faint tension. There is relief from tension at the end. I did not experience any emotion in it.'

For the sake of clearness in analysis and discussion we venture to construct, with the aid of the introspections, a general statement or outline of this experience of excitement-repose. Supposing the feeling to be coincident with the beginning of the first phrase, the feeling in the direction of excitement follows the rise in pitch and intensity of the melody, until the end, where the feeling is suspended, i. e., complete rest is not attained and expectation enters. Coincident with the beginning of the second phrase there is first a diffused feeling of satisfaction, and the feeling curve following the melodic outline may be, often is, in contrast to that of the first phrase. At the end of this phrase the feeling more nearly approaches rest; but since it does not reach complete rest, expectation again enters followed by satisfaction at the beginning of the third phrase. Here the feeling curve is often similar to that of the first phrase but of greater intensity, again following the melodic outline which, in this case, rises to higher pitch and greater intensity. Thus we find a recurrent rise and fall in feeling not only in each phrase, but also a larger curve corresponding to successive phrases. This larger curve reaches its highest point at the climax of the movement or composition, after which the melody ultimately returns to the key-note, and complete rest or repose and satisfaction are attained. It is evident that any number of variations of the above periodicity are possible. If now the reader will bear in mind this general outline he will find that the following analysis conforms with the schema and becomes more readily intelligible.

The part played by expectation and satisfaction in the rise and fall of feeling is difficult of analysis. In some cases it seems clear that the degree of expectancy is conditioned, in part at least, by the degree of feeling. In other cases both expectation and satisfaction are present when the rise and fall of feeling is not present, or as the auditor quoted above says: 'There is no emotion in it.' We are of the opinion that the expectancy here is in great measure analogous with attention, and that the degree of expectancy is coincident with

the degree of interest. On the musical side, two forces are at work in the development of the feeling; changes in pitch, speed and intensity; and the effect of tonal relationships. The sinking back to repose is largely due to the return in the direction of the tonic; and expectation is aroused through a temporary break in this movement; but the particular feeling of repose with which we are here concerned is not due solely to the satisfaction of the return to the key note. The difference is clearly seen when the music ends, with a rising cadence, on a tonic of high pitch. Here is felt the satisfaction of having attained the end but with enthusiasm or excitement.

It is also evident from the introspections quoted above that, on the bodily side, the rise and fall of feeling are correlated with muscular tension and relaxation, not only in the muscles of the extremities, but also in the respiratory muscles. The kymographic tracings of the respiration show unmistakably that when attention is directed to the phrasing the respiration follows the phrases. But these modifications in the general musculature accompany expectation and satisfaction when no other emotion than pleasantness is felt. It is impossible, therefore, to say that excitement-repose is conditioned solely by muscular processes.

The most important condition for the origination of this feeling is contained in the attitude of the observer. The following introspection represents a fairly successful attempt to describe the situation. 'The feeling is due to my own activity; I live the music; it becomes identified with myself; I forget everything outside; the music becomes the expression of my own feeling; it is only when I reflect that I objectify the music.' Numerous similar citations from the introspections might be added. It is this empathy that gives significance to the mimetic movements of singing, playing, and conducting, marching and dancing, of the apparent motivation of the music by the respiration, etc. All of these movements may be present in the body of the observer and no emotion result. It is only when the auditor feels himself into the situation, identifies himself with the music, allows it to become the expression of his own activity, that the emotion appears.

In our description of this feeling as of the dimension excitement-repose we have been guided principally by the reports of three of our observers who were asked repeatedly to analyze the experiences. The Wundtian theory was known to all of our auditors, although none have been able to accept

it. They did not know that Wundt has said that tones usually bring out affective processes of the two dimensions, pleasantness-unpleasantness and excitement-depression. Yet in attempting the analysis of this feeling, the Wundtian terminology occurred to one observer, and two others were asked whether excitement-depression would describe their experience. All agree,—and independently,—in substituting 'rest' or 'repose' for 'depression.' Two agree in accepting the term 'excitement'; one says 'It is not unlike the excitement in a game.' Another says 'It is the same feeling that you have when you want to throw up your hat.' All believe that it is generically the same as the pent-up feeling that demands expression in applause, shouting, cheering, singing and the like. One observer believes that it is the feeling one has in listening to a fine orator as he reaches his climax. Other expressions have been used, such as 'fervor,' 'interest,' 'enthusiasm,' 'a feeling of activity,' etc.

All observers agree in reporting that these waves of feeling are pleasant throughout. They were asked, in a special instruction, to correlate the curve of pleasantness-unpleasantness with that of excitement-repose. One observer reported that, at the beginning, the curve of pleasantness rises with that of excitement; but when excitement falls in the direction of repose, the pleasantness curve remains practically stationary. In other words, so far as he was able to introspect, the feeling in the direction of repose was equally pleasant with that of excitement. In one instance, there was a rise in pleasantness due to the timbre, in another, to an attractive variation of the theme. The writer is convinced that the feelings cannot be arranged into a one-dimensional series without doing violence to the facts. Our introspective evidence justifies the conclusion that the feelings arrange themselves between two pairs of poles in two dimensions of space. One of these pairs can best be described as pleasantness-unpleasantness. The other pair is more difficult to definitize and to describe; the most appropriate terms for this pair seem to be excitement-repose.*

The emotional experiences which our observers reported are to be characterized rather as moods than as emotions in

* Titchener (*Phil. Stud.* XX., 1902, 404f.), Orth (*Gefühl und Bewusstseinslage*; Berlin, 1903. 66.) and others advocate the view that all of the simple feelings will be arranged in a one-dimensional series,—pleasantness-unpleasantness. In addition to these primary feelings, however, they recognize the existence of active or exciting, and passive or calming (depressing) pleasantness-unpleasantness.

the ordinary sense of the term. While it is true that the conscious content of the mood is similar to that of the emotion, yet the temporal course and life-history of the former is different from that of the latter. The emotion is temporary and evanescent; the mood is relatively permanent and stable. Emotions were by no means lacking, of course, but since they were, in the nature of the case, transient and fluent, they seemed, to the observers, to constitute a less significant part of the emotive experience. Nor were the moods wholly constant and unchanging throughout their temporal course. For while it frequently happened that an observer began his sitting with a definite mood upon him, and while he frequently felt that he was incapable of ridding himself of his mood,—which in numerous instances he found to militate against the enjoyment of such musical compositions as did not conform with the character of the mood,—yet it was characteristic of the mood itself that it was subject to transformation. Nothing is more patent from our observations than the fact that the character of the mood varies with variations in the character of the musical stimulus. For instance, so long as the musical composition continued to be made up essentially of strongly accented rhythms, of notes of short duration or of moderate or high pitch, of chords in major keys, the mood continued to be cheerful, happy and gay. But so soon as weak rhythms, sustained notes, notes of relatively low pitch, chords in minor keys are introduced, the mood becomes more or less sad, serious, sombre. And this new mood persisted so long as the music progressed in essentially unaltered character.

It seems impossible from the data at hand to furnish a systematic classification of the moods which were experienced, as the reader will observe from the following list of descriptive terms which were most frequently found in our introspections: happy, gay, lively, joyous, cheerful, exhilarating, playful, restful, soothing, tender, quiet, peaceful, coquettish, triumphant, sad, sombre, yearning, serious, longing, disquieting, restless, unhappy, weird, pensive, mournful, despairing, cheerless.

Fn. 'It was like getting out in a summer's breeze, when you feel like throwing your hat into the air.' Fs. 'The mood was a weird and mysterious longing for something. A mood not of sadness, but inclining toward sadness. I did not know what.' 'There was a feeling of general melancholy meditation. This was not an emotion but a mood, long drawn out.' 'In addition to this was the mood: mock seriousness, the life of a butterfly; all this is emotive, but it is diffused.' 'About the middle there was a mood, a weird sort of a feeling like that aroused on hearing a ghost story; it was decidedly pleasant.' 'The rapidity of the motion overcame a tendency of the chords to sadness. A new

mood came in, due to a tendency to a compromise between the graceful movement and the harmony. The movement was joyous, the chords were sad.'

W. 'This composition would make a lovely lullaby, the swing, the evenness of tone; it is soothing; one has a tendency to become drowsy.' 'The melody has a plaintive tone, a mournful something; the affective tone is sad.' V. 'Toward the close, the affective tone became more marked; the mood which would come on such a night came over me; this was not so strong as melancholy,—pensive, rather. It was not connected with any event, time or place.' 'The effect was very soothing.' 'The mood was pensive, softened,—not unhappy, brooding.' Again, after describing a visual image of a triumphant Roman procession. 'I did not feel the triumph, but I felt a solemn thanksgiving; it was not exultant.' H.H. 'A mood of day-dreaming, sort of sadness, a man disappointed in love, or some such thing.' S. 'It made me feel sad, not unpleasant, but calm, quiescent, a feeling of revery.'

The question very naturally arises as to whether the same composition induces the same mood in different individuals. In certain inspections (analytical or intellectual) a mood was not always reported, so that comparison is not always possible. In one of the preliminary experiments the question: 'Did the composition give rise to a mood, and if so, what was it?' was asked after each experiment. The names of the compositions and the answers received are here appended.

Hexentanz, *MacDowell*. The contrast section of this composition was wholly different in character from the first section, which induced the dominant mood. Occasionally only a dominant mood was reported for the reason that this mood persisted throughout the contrast section; at other times two moods were present. The replies of the eight auditors follow: (1) happy; ominous; (2) joyous; (3) joyous and happy; (4) spirit of play; (5) joyous, coquettish, abandon; (6) joyous, at times rising to ecstasy; (7) happy; melancholy; (8) joyous abandon; mystery; riot of pure joy.

Étude, *Chopin*. (1) passionate, but under control; (2) like certain Tennyson poems or a water-fall in the woods; (3) active and happy; (4) clear, bright, and sparkling; (5) happy and free.

Nocturne, *Bohn*. (1) indefinite, indescribable mood; (2) lonesome; (3) summer night; (4) soothing; (5) dreamy; (6) loving and pensive; (7) dreamy; (8) suggestion of happiness.

Minuet, *Bachmann*. (1) stately and courtly; (2) dignified; (3) active, much vivacity; (4) optimistic but dignified withal; (5) solemn; (6) peaceful, restful; (7) longing and sad sweetness.

It is evident that some of these replies express nothing more than the general action and movement of the composition. But since, after all, it is characteristic of moods that they are not clear, definite, and easily describable, and since, for this reason, different individuals might readily employ different terms to describe moods which are essentially the same, these replies show a remarkable agreement, although of course we would not maintain that different individuals invariably feel the same mood while listening to the same composition. The inducing of a mood depends upon a number of factors: the individuality and the temperament of the auditor; the degree of passivity of his attention; his extraneous associations; and the initial mood which he brought to the hearing of the composition. For instance, one auditor did not like a selection because it did not conform with his mood. On the other hand, the nature of the composition must be considered; little mood is aroused by the Allegro of a Haydn Sonata since it is 'classic,'

formal; it is pure tonal art as opposed to the 'romantic' in music which makes a more direct appeal to the emotions. The timbre of the instrument also plays a part,—the flute does not suggest the mood of exaltation as do the trombone, the pipe organ, etc. With these exceptions in mind, we may safely say that music of a certain sort may easily arouse such a mood as may be expressed in terms of confidence, yearning, imploring tenderness, mysteriousness, lightness or daintiness, elation, joy, triumph, etc.; but in every instance the listener must give himself up to the music and allow it to become the expression of his own feeling. Gurney has often been quoted as saying, 'The yearning in music is but the yearning of one note for another.' It is only when the auditor yearns with the sound, and it in turn becomes the expression of his own inner striving, that the mood is felt. The psychologist would describe this phenomenon in terms of expectation and of empathy.

F. Individual Differences

Certain typical differences in the attitudes and procedures and mental contents of the several auditors have already been indicated. Any attempt to describe or to classify these individual variations encounters a two-fold difficulty, because the types which are here represented are neither wholly discrete nor sharply demarcated, but merge into one another through intermediate gradations; and because the typical differences themselves must be described from various points of view if we are to obtain a complete envisagement of their characteristics. We shall, therefore, endeavor to describe the more prominent traits of imagery, associations, emotions and moods, attention, bodily reactions, and finally, certain miscellaneous characteristics of attitude and procedure.

Observer R. This auditor was characterized by an exceedingly great profusion and a great vividness of visual imagery. These visual images were never static, but always referred to objects which were in active movement throughout,—dancing, marching, and the like. Familiar associations were rarely present, *i.e.*, only in very exceptional cases did this auditor report that musical selections aroused memories of past experiences. Emotion and mood were invariably present in more or less intensive form, although these two mental contents seldom expressed themselves in detectable motor reactions. It is particularly characteristic of this auditor that her experience usually assumed the form of a mood rather than of an emotion. Although muscular reactions were lacking, her visual-motor imagery was exceedingly vivid and definite; she herself was either an active participant in the dances, marches, etc., or an exceedingly interested and keenly observant spectator of these scenes. It should be noted that these imaginal contents were by no means mere memories of the past; unfamiliar scenes, and unfamiliar steps and figures

in dancing were frequently present, and present in such intensive degree that she was able, after the sitting, to demonstrate the novel steps and figures of the dance. It is also characteristic of this auditor that her imagery always assumed coherence and system,—it was always a story, a drama, a dance, a procession, or the like; and it is also characteristic that she herself did not consciously contribute to the inventing of these coherent constructions of imagery; she was merely a participant or an on-looker. Indeed, although intensely interested, she manifested only passive and one-level attention throughout. The following excerpts are typical introspections of this observer; additional illustrations will be found on page 254.

Benedict, Carnival of Venice; Xylophone. 'When the music came, I did not know where I was; soon noticed that I was in a theatre; I thought that a drama was coming; a lady wearing a green dress came in and began to dance. Her skirts flew just like a butterfly; sometimes she jumped and one really thought she was flying. Suddenly a whole group of girls came in and they tried to dance with her. Finally the girls went back and disappeared. Then boys came in, danced like the rest and disappeared. During the last part of the music the woman first danced alone, then the girls came in and danced with her. Their movements were exceedingly rapid,—zigzag and flitting. The figures they formed on the stage were much like a figure eight.'

Hausser, Cradle Song; Cello. 'After one or two phrases I saw a landscape—moonlight, castle with garden, lighted window; could see young people; a piano was playing. Outside a man was singing a love song to the girl who was playing the piano. His face was sad; he would so like to have her hear him. She began to play again; he sang his song again. Suddenly he stopped and turned; his face was very sad. Then another man came from the garden and looked at the man who sang. Then the song was sung again. The singer went to the door and put on his hat; he was dressed like the trumpeter of Säckingen. I could see the white ruchings on his sleeve. At the last, he was standing at the door, looking hopelessly at the floor. He did not know whether to go or not. I was standing perfectly still; I felt with him.' After an interval of sixteen days, the same composition (Cradle Song) was played again. On this occasion, her report was as follows: 'I saw a sunny landscape, houses, gardens and flowers. It was autumn. In one house, a girl was playing a piano and a man was singing. The song tried to express his desire for her to go away with him. His face was unhappy because she refused; he begged her to go; told her how he would feel if she did not go. She was happy, apparently, an ironical smile,—she was probably trying to deceive him. Suddenly he touched her on the shoulder; she looked up, saw his face, and became excited, but in her heart she did not care. His face took on a more hopeless expression; he sang with more and more feeling. Once or twice he felt hope; he thought of the happy future they might have together. At the last, he gave up entirely and put down the music with great sadness. He continually gestured with his head, eyes, and hands; she continually played the piano.'

Observer Fn. In this auditor, visual imagery was almost wholly lacking; and when it did occur, it apparently played an exceedingly insignificant rôle. He almost invariably reported a profusion of auditory images; motor images were usually present, though in lesser degree. The auditory imagery was concerned with the *Abklingen* of notes that had just been heard, or with the anticipation and prediction of notes which were, in his opinion, likely to follow. His motor imagery had to do chiefly with imagined reactions to the rhythm, and in lesser degree, to the phrasing; imagined or executed movements, which are concerned in the act of playing the violin, were also present in some degree throughout. It was characteristic of this observer that he frequently tended to localize pitches and changes of pitch in a graphic schema in external space,—a procedure which was accomplished in purely motor fashion. It sometimes happened that definite associations from the past were present when the musical composition was familiar, but these played an insignificant part in his enjoyment of music; for instance, familiar compositions were enjoyed, not because of their wealth of pleasing associations from the past, but because their familiarity facilitated the auditor's analysis and his prediction of the development of the theme. His attention was active throughout, save in those rare instances where his typical attempts to analyze the composition failed utterly, and where, for that reason, he lost interest in the composition. His emotive experience was usually characterized by the presence of emotions rather than of moods; and his emotions almost invariably assumed a two-dimensional form, pleasantness-unpleasantness, excitement-repose. Moods, however, were not wholly lacking, especially when the less active sort of attention was present. His bodily reactions had to do, in almost every instance, with his own imagined act of playing the composition upon his violin.

The essential characteristic of Fn.'s attitude and procedure is describable as intellectual or analytic. He invariably analyzed the work of the composer, and endeavored throughout to understand and even to predict the development of the composition. And his enjoyment of music is determined essentially by the success with which he meets in his analysis and prediction.

Rubenstein, Melody in F; violin and piano. 'My first thought was: 'I heard it last evening;' the whole situation came back, chiefly in visual terms. Then I returned to the present rendition. I began to think the music; simply took it in, and played with my imagery, which

was almost exclusively auditory. Then I thought: 'Pshaw, I am not listening, but after all, this is the way I listen to music.' About the third section, where the bass goes up and down, I vocalized it; I made no sound but felt it in my lips. This composition is interesting to the very end, due, I think, to the rhythm; there is always something new throughout. The *diminuendo* and the *retard* at the end interest me most. When the music was over, I said almost aloud: "O, that's fine, that's fine." Then my attention drifted away for fifteen or thirty seconds. By playing with the imagery, I mean that I recall the notes which have just been heard and compare them with the present notes as to pitch, duration, and intensity. I also anticipate what is likely to follow. I do not follow the notes with my throat, but I simply hear them as if they were still ringing in my ears. This image is very much like hearing the same notes over again. I can readily reproduce the last phrase or two; and I like this reproduced sound even better than the sound which is objectively present.'

The following excerpts illustrate this auditor's kinaesthetic reaction: 'I felt this selection as if I were playing it myself; I could feel the action of the bow and of the moving fingers.' 'Near the beginning, I had a distinct motor image of my arm playing the music.' 'I had an experience as though I were sitting in the orchestra and were myself playing the selection; I localized the up-and-down of the music; this is motor, not visual. I had a motor image which assumed the form of a graphic outline movement, somewhat like the attention curve.'

Braga, Angel Serenade; Violin and Cello. 'A feeling of familiarity when the music began though I could not recall the name. However, I knew it sufficiently well to be able to anticipate what was coming. At first I followed the music very closely, listened, spanned, anticipated, with auditory imagery. When the cello entered I began to vocalize, made no noise but felt the strain in my throat. I thought that the cello part was fine, it made such a splendid contrast. I noticed suspense or expectation at the end of phrases. Then attention wandered, drifted away; I did not vocalize any more; I cannot recall what my thoughts were at this point. Then I returned to the analysis of the music; became aware of myself as analyzing. I anticipated the end of the composition, thought it was fine; it let me down so easily. Attention was fluctuating throughout. The selection was familiar so that at times I drifted in a vague, dreamy way. The mood was quietness, restfulness. There was some excitement near the end; but pleasurable throughout.'

Observer Fs. This auditor reported visual and motor imagery much more frequently than auditory images. Her visual images occasionally but rarely assumed the form of a coherent story, and these stories were exceedingly brief and intermittent. Her motor imagery usually had to do with her own act of playing the violin or piano; occasionally, it had to do with dances in which she participated. The visual imagery almost invariably found a setting in a ball-room scene, or the like; but she also visualized the performers who produced the music. The associations aroused by the music were numerous; they usually concerned the situations in which the composition had formerly been heard; her atten-

tion was intermittently active and passive. When active attention was present, it was concentrated upon the *timbres* of particular instruments, unusual rhythms, novel chord progressions, and especially upon the quality,—excellent or mediocre,—of the rendition. Her emotive experiences were most frequently characterized by pleasantness-unpleasantness; excitement-repose were reported in numerous instances, but sometimes they were not present. The emotive experience usually took the form of a mood when her attention was passive; and it may be added that visual imagery and extraneous associations were seldom present, excepting in passive attention. Her bodily reactions were frequently and intensively experienced; these usually had to do with the act of playing the violin or the piano, but occasionally she reported kinaesthetic imagery and kinaesthetic sensations which were concerned in the experiences of expectation, and of excitement and relaxation.

Hauser, Cradle Song; Cello. 'During the fore-period I was curious as to what the music would be. I recognized the composition within a few seconds; a slight uneasiness before the name occurred to me; then a slight lapse of attention. I seemed to be playing the cello myself, and I was conscious of the difficulty of bringing out the tone upon the cello,—it is so different from the violin; this was motor imagery; had a vague feeling of discomfort in trying to play it; then a dim, visual image of a friend who plays the cello, an intermittent image of him as he appeared at an entertainment last winter; the skillfully performed *portamento* gave me a sustained pleasantness; close attention throughout, but stronger where the pleasure was greater. I usually held my breath a little at the end of movements; the attention varied; more attention when more pleasing; in several places I had a motor image of playing the accompaniment on the piano, a specially clear image of striking the octaves in the bass with my left hand; no imagery of my right hand (in the plethysmograph); clearly conscious of the rhythm at times, and of a tendency to sing at times; toward the close I was very attentive, to the harmonics, especially; I knew that it was coming to an end but did not anticipate what was coming next; after the close, a distinct awareness of relaxation; and I lingered on the feeling of pleasure.'

Sousa, Diplomat March; Military Band. 'Concentration of attention came slowly; I realized that it was a march; clearly aware of the rhythm; innervation in the foot and left hand, none in the right hand; visual image of soldiers marching and keeping time, but I did not see any faces; for a time I tried to single out the various instruments; at the change in movement, I had a visual image of the grand march, pale pink and cream dresses, and the black of the men's suits. This scene was not very clear; the line was actually moving; I was not aware of any movements of my own; when the music changed, the figure of the march changed; my attention shifted, and an instant later, I was listening to the flute, the visual picture having receded; later, everybody began to dance; I got a visual-tactual-motor image of the smooth floor under my feet.'

Observer W. This auditor reported not a single instance of auditory imagery; her visual imagery, while vivid, was usually fluctuating and intermittent. Her motor imagery was exceedingly clear and profuse throughout; it usually had to do with singing or with the oscillation of the whole body, floating in space, to the rhythm of the music. Her associations were frequent; they were memories of persons or scenes which had formerly been associated with the familiar musical selection. Her attention was for the most part passive, but occasionally it assumed an active form, especially when she was interested in picking out particular instruments from the orchestra, and when she admired the skill of the performers. The play of visual and motor imagery, with their extraneous associations, usually ran their course in passive attention. Moods were frequently reported, and emotions were invariably present. In these emotive experiences, both pleasantness-unpleasantness and excitement-repose were of frequent occurrence. Her bodily reactions, either imaginal or real, were the most prominent components of her experiences. Various parts of her body, hands, feet, trunk, head were concerned in these reactions; she marked the rhythm, and usually was aware of muscular sensations and imagery in the presence of scale passages, and of abrupt changes in pitch and in rates of succession. Her respiration almost invariably changed in both depth and rapidity with the change in the movement of the music.

Victor Herbert, Badinage; Orchestra. 'This composition was very interesting, both in melody and in rhythm; had no visual imagery until near the middle; felt muscles of face move; music such as this, containing quick steps, followed by slow steps, gives me great pleasure; at the change in movement, I saw boats on the water in the moonlight, the oars keeping time to the music; I heard music and wondered where it came from; I thought it must be from an orchestra on the boat; there was a charming scurry near the end of the selection; my pleasure was chiefly motor; I picked out tones of some of the instruments, noticed the harp especially; did not see the players; I felt the run up the piano scale, but did not see the piano.'

Rubenstein, Melody in F; violin and piano. 'The first thing of which I was aware was a consciousness of pleasure; I felt as though my whole body were swaying without any active movement on my part; I was out in space, not touching the earth. If my body could have been connected with an automatograph, it would have swung to the right for two movements, then to the left for two movements; this lasted throughout; visual image of a friend who plays the violin; she sways a little while she plays; I saw and heard her breathe; at the interlude, I saw her take down her bow and screw it more tightly; I felt my head moving at one passage; felt release from tension when the music stopped.'

'The experience was motor throughout, a distinct tendency to move my head, hands, feet, and fingers, but I believe I inhibited the movements of my hand.' (The plethysmographic record shows that she did not.) 'I felt as though I were being swung in a hammock. Sometimes I have a tonal image which sways, as if the tone were swinging back and forth like a pendulum. The music arouses motor tendencies immediately, first in one shoulder and then in the other, then in legs and feet; finally, a dim, visual image of the dance. I frequently feel as though I should like to dance while the music is being played, and, indeed, I sometimes feel as if I were dancing.'

Observer H. This auditor rarely reported a visual image. At infrequent intervals, he seemed to see the conductor, the orchestral instruments, etc., but these images were vague and fleeting. He very often reported auditory imagery,—parts of themes and motives, and even individual tones, in their appropriate clang-tint. The distinguishing characteristic of H. was his invariable tendency to movements of all sorts,—humming, singing, whistling, beating time, dancing, marching, and the like. Motor imagery was rarely found, and then only of a vocal motor sort; this negative report is probably due, in part at least, to the fact that the actual movements were themselves present. It seldom happened that the music recalled memories from past experience; yet his reactions to familiar and to unfamiliar compositions were characteristically different. In the former case, he attends closely to the music throughout, and he is aware throughout of definite and intensive muscular movements; in the latter case, his attention is not held by the composition, but wanders away to such incidental matters as introspective data which he will subsequently report, to the mechanical perfection of the phonograph and the like. Pleasantness-unpleasantness and excitement-repose are experienced in marked degree. As already indicated, this auditor is characterized by an exceedingly intensive motor reaction to music. He reports that these actually executed movements of all parts of his body are absolutely essential to his enjoyment of music. Music which is heard in a brightly illuminated auditorium or in a dignified assemblage loses its charm because he feels obliged to restrain his motor expression.

Sousa, Diplomat March; Military Band. 'The music came with a bang. I fell in with it and marched down the street; my head, arms, legs, fingers, my whole body, moved with it. Soon I began to whistle the tune; this took more attention, and my legs, arms, etc., stopped as if satisfied. I did not whistle throughout; near the end of the composition, my hand began to move again. I forgot all about my headache, did not care what the music was; did not notice the instruments except that they were all wind instruments, and mostly brass-wind.'

Wagner, Prize Song; Cello. 'The music came gently; it did not dis-

turb me nor raise much enthusiasm. There was little impulse to move the hands or feet or to sing. I realized that it was a cello solo with piano accompaniment; unfamiliar; once or twice felt that I ought to know what it was; realized the richness of the tones; felt that it was an excellent composition. There was a slight twitching of muscle in the upper fore-arm after the first interlude. At the close, my mind was away from the music; near the last I wondered what sort of a selection it was; tried vaguely to recall how many motives there were.'

After concluding an introspection on one occasion, he said: 'There are two kinds of motor reaction,—keeping time and singing. The latter brings in the clang-tint; where these two are combined, I find my greatest pleasure. I enjoy rich, full chords without the time element; this is more static,—the joy of reverie. The former is activity; it is like a long march, where one stops occasionally to enjoy the scenery.' Again, he said, 'I feel as if my whole body moves with the swells of the music, like the movement of the violin bow.'

Observer V. The auditory imagery of this auditor was inconspicuous, although occasionally reported. Her visual images were exceedingly clear, detailed, and frequent; their colors were vivid and striking. She saw scenes upon a stage, processions in the street, etc., where the colors of the costumes and of the musical instruments were richly variegated and of deep saturation. Her motor imagery, however, constituted the major portion of her sensory mental content; these images were usually referred to the movements of her own members, the swaying of her body, etc. Childhood memories were frequently aroused; familiar compositions tended to reinstate former situations. Active attention was almost invariably absent; reverie, day-dreaming, and passive attention in general was characteristic of her attitude toward music. Moods were of frequent occurrence; pleasantness-unpleasantness was almost always present; excitement-repose was also reported throughout.

Pierne, Serenade; Instrumental Quartette. 'Shortly after the music came, I felt as though my body were swaying, but it was not. I was conscious of breathing deeply, and felt a strain at my hips; the swaying was from left to right; I alternately felt the strain on one hip and then on the other; this was not due to breathing but was coincident with it; had a visual image of a field of wheat swaying in the wind; when I attended to the piano and violin, I got the impression of a question and answer in the music; when the violin became fainter, the visual image faded away; also was conscious of rhythm which coincided with the motor image and the visual image; had a distinct anticipation of the close of the selection, and held myself poised for the *finale*. At intervals I noticed a tendency to move my eyes; a peaceful, pastoral, restful feeling; was lulled by the rhythm.'

Bizet, Pearl Fishers; Concert Band. 'The first thing of which I was conscious was a procession of gaudily dressed soldiers; they were not Americans; the wind was blowing the plumes in their hats; a military band was playing; the soldiers were marching; no movements in

my own legs, but contractions at hips. I saw a man standing in an open carriage bowing to the people, pale face and very red hair; blasé women with him in the carriage; lions walked in the street after the carriage. It occurred to me that this was strange, but I noticed strains in the music which sounded like the roar of lions; my visual picture persisted. Then came priests or choir boys swinging censers in rhythm; I was profoundly impressed by the motor accompaniment again. Then, I seemed to be in a church; the priests marched in slowly, and circled around; the soldiers were dressed in blue; I saw the gleam of yellow light on the censers. After the music had stopped, I was confused by the incongruity of it all. This is my ordinary way of reacting to music. When I am fatigued, it always rests me to hear good music because it carries me so far afield, I see so many unusual spectacles; the music suggested a story, an Arthurian legend. I was very much impressed by the dignity and beauty of the court; it was a peculiar feeling with a tinge of sadness in it. I was in the country; dark clouds were scudding across the moon; a melancholy weird place. The piano at first suggested the rustle of leaves, but this did not suit; then, it suggested an expanse of water; I saw the waves and the light gleaming on them. Just such a mood as would come on such a night was present here; it was pensive, rather than melancholy. The change in time was followed by muscular strains in my arm and hand; I followed the rapid little places on my toes; in the slower parts I had a tendency to hold my muscles in suspense, waiting for the rapid places; the music was not pleasant, because it was fatiguing to remain so long on my toes.'

Observer C. This auditor was characterized by a total dearth of auditory imagery; nor was visual imagery ever reported, save in exceedingly rare instances. His dominant imagery was of a motor sort, usually vocal-motor, although there were frequent manual-motor images which had to do with the localization of the pitch relations in a graphic schema in external space. Memories of former situations and former experiences were frequently aroused by familiar selections. His attention was active throughout. This auditor was interested in the compositions as a psychologist, and not as a musician; his was a distinctly introspective attitude, but he insisted that this was his typical attitude in listening to music. Unfamiliar compositions and compositions in which the melody was not prominent usually failed to interest him, and he gave more non-emotional introspections than any other of our auditors; but moods of various sorts and the emotion of pleasantness were usually reported when the selection was familiar. His most prominent reaction was of a motor sort; various parts of his body reacted to rhythm and to melody; and the experiences of expectation and satisfaction were accompanied by muscular tension and relaxation. He is convinced that these muscular reactions play a prominent part in his enjoyment of music.

Hauser, Cradle Song; Cello. 'When the music came, there was a relaxation. I tried to recognize it but could not; I noticed the violin,—vocal-motor image of violin. I anticipated to see whether the note would go up or down,—a tendency to accompany the change in pitch with my body, to ride with it; often, the note does not go where I want it to go. I noticed the piano accompaniment late. There was a constant motor accompaniment,—head and eye-brows, and changes in breathing; I forgot my right arm entirely. I enjoyed the music; it was restful; almost but not quite melancholy.'

Herbert, Badinage; Orchestra. 'Music came rather suddenly; feeling 'I like that.' There was a relaxation; a feeling of disappointment when I discovered the jerkiness of it. Music faded a little and a partly visual image of the orchestra came; I saw more of the leader than usual. The quick little passage was vaguely projected a little above me with a movement something like writing in the air; this was visual-motor. At one place, I thought the music would cease; I was all attention, but it did not stop; there was a pause, a little uncertainty, then music went on again. I felt a settling back as before,—a change in the muscular feel, but this was vague. Feeling 'Why does he break it up so'—awareness of thought: 'It is going to settle down.' A visual image of one end of the orchestra at a theatre; vague verbal image of 'Poli's Theatre.' When at last, the conventional form of the *finale* approached I recognized it clearly.'

Observer S. This observer occasionally reported visual imagery; he seemed to see the conductor of the orchestra or the orchestra itself. Auditory imagery was wholly lacking. His motor imagery was frequent and vivid; and in addition, he tended to beat time and to sway to the music. Memories of former experiences were sometimes aroused by the compositions; but his most frequent memories had to do with similar compositions which were suggested by the present selection. His attention was almost invariably passive; and there never was any attempt to analyze musical compositions. He reported emotions of pleasantness, excitement and repose, but none of these were ever present in intensive degree. In the case of excitement, he was always aware of muscular tenseness. His moods included only those which might be described in such terms as 'quiet' or 'excited.' The chief component of his mental content was almost entirely motor. He was conscious of rhythmic muscular movements throughout. The pitch relationships were projected into external space in a motor-visual schema; his memory of musical compositions always assumes this form.⁷

Sousa, Diplomat March; Concert Band. 'When the music began, I had almost immediately a visual image of a band standing in circular formation. Each musician was swaying to the music, and I seemed to

⁷ It may be added in this connection, that S. possesses an exceedingly definite motor-visual number-form which, he reports, is of distinct service to him in his dealing with numerical relations.

be swaying myself; I had a visual image of the band-master beating time with a baton; I was conscious of the rhythm, and I seemed to be swaying with it; I had no tendency to keep time with hands or feet, but only with my body as a whole; at no time was I aware of the presence of the apparatus or of the phonograph; I was conscious only of the band and of the music; I saw the players take down their instruments at certain stages during the selection, and put them up again before they began to play.'

Toboni, Hungarian Fantasia; Orchestra. 'No imagery except muscular; I seemed to sway up and down in the air; in several places I felt as if I were conducting the orchestra; I felt myself going through the motions; when one instrument came in *solo* and the others came in later, I felt as if I were being dragged, as if I were heavy; I seemed to be responsible for holding the instruments together; I must do my part or the orchestra will break down; I knew when the *finale* was coming; this came in motor terms. When the music suddenly stopped, I seemed to come down with a thud; when it rose to a climax, I rose with it, became more tense, then I dropped.'

A survey of the introspective descriptions of our eight auditors reveals the fact that while they all possess certain characteristics in common, yet they manifest wide individual differences. It is therefore difficult, if not impossible, to classify musical attitudes and musical enjoyment into types, if by types we mean absolute differences in habitual mode of reaction. The individual variations which have been revealed are differences in degree only. For instance, the attitude of every auditor partakes in some degree of the characteristic which is describable as intellectual, in the sense that it is critical and evaluating. That which is evaluated, however, may, in one case, be the art of the performer, and in another case, the art of the composer. The standard of evaluation may vary between exceedingly wide limits,—between the criteria of the naïve and unsophisticated dilettante and the criteria of the educated and refined musician. This critical or evaluating or intellectual attitude is the most conspicuous attribute of the trained and cultured auditor, while it is a wholly subordinate characteristic in the naïve and untrained auditor. While it is possible to regard these two individuals, manifesting such extreme differences of attitudes as they do, as representatives of different types, one finds that the matter of classification is complicated, in practical experience, by the fact that numerous intermediate variants of attitude are interpolated between these two extremes; and the same difficulty will be encountered if we choose any other characteristic in the auditor as our basis of classification.

When we compare the several descriptions, point for point, we find that no essential differences between individuals are revealed in so far as emotive experience and motor reactions

are concerned, and that the greatest differences have to do with imaginal content, behavior of attention, and general attitude toward music. There are individuals in whom visual imagery *per se* constitutes a chief basis of musical enjoyment; and there are individuals in whom visual imagery makes no direct contribution whatever to musical enjoyment. It is true that these two types of individual are also distinguished by differences in attitude and by differences in behavior of attention; the former type of auditor is usually a relatively impassive spectator of a kaleidoscopic scene,—a dance, a drama, or a procession. Not only is this auditor characterized by a passive attention; he is also characterized by a relatively uncritical attitude toward the work both of the performer and of the composer. On the other hand, the individual in whom visual imagery plays no significant part, may derive his enjoyment from either of two sources: from his motor reactions, in which case he represents a mode of procedure which is common to all auditors, but which is here present in exaggerated form; or, from his auditory imagery, which in turn, furnishes him with the means of analyzing the work of the composer and of appreciating the subtler shadings of musical meaning which are lost to the auditor who does not habitually adopt this analytical procedure. It is to be added that characteristic differences of attention are also exemplified in these several types of auditor. The analyst must, in the very nature of the case, concentrate a high degree of attention upon the task he is undertaking if that task is to be successfully accomplished; on the other hand, the auditor who derives his keenest enjoyment from involuntary motor reaction to the music, or from a vivid play of imagery of which he is a mere spectator, may be characterized by the fact that his attention is the very opposite of active. Concomitant with this difference of attitude and with the corresponding difference of attention is a difference of source of enjoyment. In the case of the analyst, enjoyment is essentially due to an intellectual appreciation of the art of the composer (and of the performer); in the case of the non-analytic type of auditor, enjoyment is essentially of sensory origin,—traceable to pleasing timbres and nuances of tone, to pleasurable associations aroused by the composition, to enjoyable motor reactions, to rhythm, to changes in pitch, and the like.

Our introspective descriptions show no qualitative differences between observers in so far as emotive experiences

and motor reactions are concerned. They do, however, show exceedingly great differences in the degree in which these two factors may be present; and these differences are so great as to constitute a difference in type of auditor. Certain auditors assume a coldly critical attitude; their rôle is exclusively that of the observer of a production in which they take no part; these auditors are relatively inactive. Their motor reactions play an insignificant part; and their emotions are usually describable in terms of pleasantness and unpleasantness alone. In the case of the auditor of the other type, the music is an expression of himself; he feels himself into it; he himself moves with it; and his *Einfühlung* and his *Mitbewegung* are of paramount significance throughout. The extreme representative of this type cares little for the analysis of the composition as a work of art. His enjoyment is due, in great measure, to his own imagined or real activity. The dimension of excitement-repose is here added to that of pleasantness-unpleasantness; and moods are usually present in more intensive form. The musician of exceptional temperament and exceptional culture probably represents the analytical attitude in more extreme form than was observed in any of our auditors; and it seems to be equally probable that the average auditor is to be assigned to a position between the two extremes which we have described.

V. CONCLUSIONS

In the foregoing descriptions and citations from the introspections of our observers, we have endeavored to include every important item which seemed to have significance for the appreciation and enjoyment of music. The experiment proved to be a revelation not only to the observers, who continued to develop more and more introspective skill as the experiment progressed and who never ceased to wonder at the invariable presence and apparent functional significance of their kinaesthetic experiences both sensational and imaginal, but also to the writer, who, after several years' experience as a college teacher of music, was guilty of a bias toward a purely auditory enjoyment of music.

The summary and conclusions which follow are therefore, entirely the conclusions to which the facts established in the investigation have impelled us. The conclusions may be summarized under two heads.

A. *Physiological*

1. Listening to music is accompanied by disturbances in the distribution of the blood supply; but there are numerous indications that these circulatory changes may be referred, for the most part, to variations in the function of attention; and that they are not symptoms or products of emotional variations or of any other variations which are characteristic exclusively of music as such.

2. Under the influence of music, the heart-rate tends to increase; whether attention be voluntary or involuntary, active or passive, and whether the tempo of the music be fast or slow.

3. Under the influence of music, the chief characteristic of respiration is irregularity, both as to rate and as to amplitude. This degree of irregularity varies directly with the intensity of the emotion experienced by the observer. The rate of respiration, while irregular, tends to increase over the normal. No constant correlation between respiration and the musical phrasing can be established.

4. The muscular reactions, including not only those movements which are made in unison with the musical rhythms, but also those movements which are found to be invariable or all but invariable attendants of feelings of strain and relaxation, are of great importance in the appreciation of music.

B. *Introspective*

1. The enjoyment of music is a complex experience. The components of this experience are or may be:

a. A pleasurable emotion which is due to the timbres of the instruments and to their nuances of tone.

This component is subject to wide individual variation. There is a distinct affective coloring which inheres in musical sounds as such; certain individuals have an especial fondness for the violin, others for the trombone, etc. Others again do not prefer the clang-tint of any particular instrument but derive an especial enjoyment from certain combinations of timbres, as *e. g.*, the combination of flute and violin, of the various wood-wind instruments, the various stringed instruments or any other *ensemble* effect.

b. A pleasurable reaction on the part of the observer himself to the rhythms of the musical composition.

This again is subject to considerable individual variation; yet it is a fact that every auditor reacts to music with a more or less definite and pronounced motor response. This response may consist in the more patent and obvious movement of beating time; and it may run the gamut through the various gradations from this crude reaction to the subtlest play of sheer images of non-executed movements. Between these two extremes are found individuals who, while the music is

being played, accompany it by singing or whistling; and individuals who evince no outward signs of such a motor response but yet who follow the melody with vivid and intense vocal-motor or manual-motor images,—with at least an occasional participation of motor innervations of slight degree.

c. Pleasurable associations which are the product, in the main, of past experiences,—associations which have now become more or less familiar to the auditor.

This component is particularly prominent during the rendition of familiar compositions. In such cases, even though the identity between the remembered and the recognized melody be only partial and approximate, the present composition tends to revive the original experience during which it was heard before, together with a wealth and variety of imaginal and emotional accompaniments.

d. Pleasure derived from the observer's play of imagery,—the latter being itself a product of the musical stimuli.

Here are included the hosts of mental images from every modality of sense, which in many instances weave themselves into a story or drama whose unfolding is a source of intense enjoyment to the combined auditor and spectator; in other instances, particularly where the auditory imagery predominates in the complex, the subject tends to predict what the composer will give him next. A successful prediction is invariably attended by a glow and suffusion of emotional warmth, due chiefly to the fact that the observer feels that he is master of the situation. Those auditors who are also trained vocalists or skilled performers upon any instrument derive intense pleasure from the act of projecting themselves into the chorus or into the orchestra, and imagining themselves as participants in the production.

e. A pleasurable mood which is usually characterized by its persistence, although it may change with changes in the character of the composition.

This mood may be due, in part, to the peculiar temperament of the individual, or, in part, to the temporary emotion which may dominate him at the instant when the musical rendition begins. Yet it is true that the composition itself may arouse a mood of its own making, and for that reason may itself be described as triumphant, yearning, confident, imploring, mournful, elating, depressive, filled with hope, with abandon, with mystery, with tenderness.

f. In addition to these more specifically emotional components, there is present also an intellectual activity which can best be described as an analysis of melodic and harmonic structure, and an appreciation of the skill or dexterity of the performance itself. Both of these more purely intellectual functions contribute to an enjoyment of the composition and of the execution of the musical selection.

2. These various components are far from being of equal value and of equal significance in the appreciation and enjoy-

ment of music. While it is not possible, in the present status of our knowledge of the topic, to seriate these several components in a systematically arranged hierarchy, still it may be said that, at least so far as our observers are concerned, visual imagery makes the least important contribution; and the contributions which flow from the observers' motor reactions constitute the most essential factor for all auditors except those whose attitude is of the purely intellectual sort.

3. Just as in the average normal auditor, emotional enjoyment is a product chiefly of motor imagery and motor reaction, so his intellectual appreciation is a function almost exclusively of auditory imagery and of intellectual processes based thereon.

4. Music is powerless to portray a definite picture in any uniform or universal sense, or to convey the same group of imagery into the minds of each of its auditors.

5. An introspective analysis of the experience of listening to music indicates the existence of a variety of types of auditor. Ideally, these types may be conceived as being, at bottom, qualitatively different; but, in practice, they may exist in such intimate combination with one another that one finds it difficult, in many instances, to discover well-marked lines of demarcation between them. The more prominent typical differences which were found to exist in our eight observers are as follows:

a. The Analytic Type: To this type belong those whose ordinary procedure consists in subjecting the musical composition and also the performance of the music to a critical analysis. A high degree of attention is normally employed; and auditory and motor imagery are prominent in greater or less degree.

b. The Motor Type: To this type belong those observers, in whom the motor reaction to music is dominant. This motor reaction may take one of two forms—singing or whistling; and movements, actual or imaginal, of other voluntary muscles. In these individuals attention may be less active; and auditory imagery may be entirely absent.

c. The Imaginative Type: To this type belong all those observers for whom music constitutes a stimulus to the imagination. Their imagery may be from any or from all sense-departments. Attention may be of various degrees; but it ordinarily tends to passivity. With the lowest degree of attention, day dreams, reveries, etc., or even, in some cases, thought processes concerning matters entirely foreign to the

music, may occupy the focus of consciousness, while the music remains in the fringe.

These types, however, are not fixed and permanent. At any time, an observer may shift from one type to another by a change in the degree of attention. For example, Fn. customarily belongs to the analytic type; if, however, he finds a composition uninteresting his reaction ceases to be analytic and becomes imaginative. This shift and variation of typical procedure is common to most observers.

d. Emotional Types. It is also possible to differentiate various types of auditor from the point of view of emotive content. For instance, the extreme representative of the intellectual or analytical type of procedure is coldly critical. Not only does it seem probable that the emotional experiences and the emotional reactions of this type of auditor never reach an exceedingly high degree of intensity, but it is also probable that his emotions are always describable in terms of pleasantness-unpleasantness. Moreover, the pleasantness-unpleasantness itself is always found to be chiefly of an intellectual sort. The opposite extreme would be represented by an individual who is wholly unaware of the meaning and of the excellence of the musical composition as a work of art. The 'musical consciousness' of such an hypothetical individual would consist exclusively of motor reactions, imaginal or real, together with a play of imagery; and it would be essentially characteristic of this individual that his attention would be absolutely passive and involuntary throughout. His emotive consciousness would consist of both moods and emotions,—the former of which are characteristically lacking in the extreme representative of the intellectual type. Moreover, the emotions of the reflex or sensory or purely naïve are distinguished by the fact that they are of a sensory sort exclusively, and by the additional fact, that they run the gamut of excitement-repose as well as of pleasantness-unpleasantness. These two extremes of type are seldom if ever encountered in practical experience. The closest approximation to the intellectual extreme is undoubtedly to be found in those composers and professional musicians who exalt the intellectual and decri the emotional in music. The opposite extreme of procedure is to be found in the purely reflex reactions of those volatile individuals who are popularly described as belonging to the emotional type. Between these two extremes of emotional procedure is to be found a place to which may be assigned any given normal auditor; and when this seriation is com-

pleted, it will be found that individuals belonging to different points upon the scale differ from one another in the following characteristics: dominance of mood; composition and content of emotion (i.e., presence or absence of *Einfühlung*, presence or absence of sensory or intellectual emotions); relative profusion and significance of imagery; relative intensity of motor reaction, real or imaginal.

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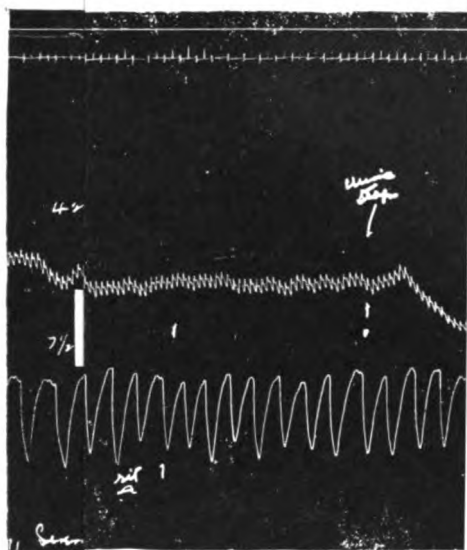
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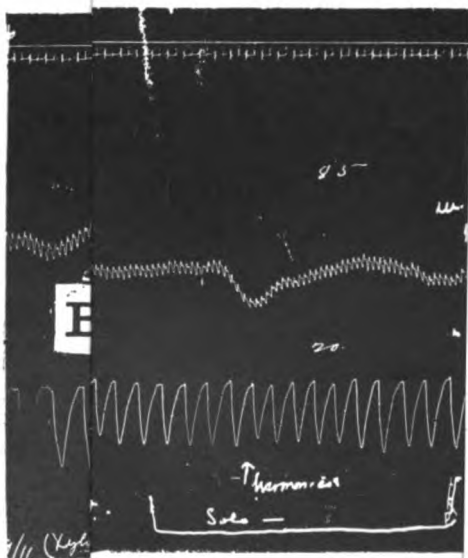
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See also Gehring (22; 169 ff.), Groos (6, 7), Gurney (23), Hanslick (26), Helmholtz (46; 366), James (39; II. 469), Lee (12), Puffer (15), Riemann (28), Shepard (106; 553), Siebeck (17), Stainer (32), Steinitzer (19), Sully (33).

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PSYCHOANALYSIS: A REVIEW OF CURRENT LITERATURE

By Dr. J. S. VAN TESLAAR

1. S. FREUD. Die Handlung der Traumdeutung in der Psychoanalyse. *Zentralblatt f. Psychoanalyse*, II., 1911, 109-113.

In this paper Freud discusses some points in the technique of dream analysis bearing on the question: what practical uses may be made of the art of dream analysis in the psychoanalytical treatment of neuroses?

It is ordinarily understood that, for clinical purposes, the analysis of dreams must be thorough. This requires a great deal of time. Before one dream has been examined completely the patient returns with other dreams which appear of even greater diagnostic import. Soon the consulting physician is overwhelmed by the amount of material on hand requiring analysis, so that he can hardly do justice to it during the hour set aside for consultation. Occasionally dreams are prolific; and the patient's understanding of the incidents recorded therein is faltering and slow. The physician's effort at penetrating the source of trouble is thwarted on all sides by the patient's subconscious unwillingness to coöperate. Meanwhile dream material keeps accumulating. Under such circumstances one feels inclined to renounce all attempts at thoroughness of analysis or else is compelled to devote attention only to a portion of the material.

Freud suggests that in all such cases it is preferable to limit one's attention to what material may be dealt with properly during the hour set aside for consultation rather than abandon thoroughness. Where a new promising dream is reported it is always well to take it up even if the analysis of an older dream is interrupted and must be postponed indefinitely. In other words, where material accumulates so fast that a choice becomes necessary it is of advantage to decide in favor of the latest dream and to set aside, if necessary, observations already made in connection with an older dream.

On the other hand, one should avoid giving to the patient the impression that a new dream is expected or is in any way essential for the proper continuation of the task of analysis. Such a notion might easily focus the patient's subconscious opposition upon the field of dream memories and the fountain source of material would suddenly run dry; there would be no dreams to report. On the contrary, the patient should be made to feel that it is immaterial for the progress of the work whether any new dreams are reported or not.

It is well to bear in mind that in severe neuroses most dreams are built upon the whole pathogenic material, the details of which are unknown to subject and physician alike, so that a complete analysis of such a dream is out of the question. It is only as physician and patient get closer together and win each other's confidence that the required light from the intimate life history of the latter is thrown upon the incidents revealed in the dream. Where the whole content of a complicated neurosis of long standing is translated into the symbolical

language of a certain dream, an exhaustive interpretation of the dream is not possible at one or two sittings or in the interval between it and another, perhaps equally interesting dream. To arrive at a complete understanding of such a dream would be to unravel the whole of the series of pathogenic complexes which the experience of a lifetime has gradually precipitated into the subconscious; and this is not possible without a knowledge of the actual incidents of intimate order out of which the complexes have thus been formed. As a rule, the examiner must remove a great deal of subconscious opposition from his path before this can be accomplished. The meaning of a dream is often uncovered rather gradually, perhaps only in the course of months, by keeping in mind its main features while the patient's analysis proceeds along other lines.

When a partly analyzed dream is abandoned for a later report, little is lost because, as a rule, new dreams only represent the same material in a different and perhaps more penetrable form. A new dream may throw a new and highly welcome side-light on the same material that was studied in a preceding dream. Indeed, sometimes the best way to unravel the meaning of a particularly baffling dream is to abandon it purposely, for a time, follow the clues of newer dreams, and compare the findings from time to time.

Freud insists that for therapeutic or diagnostic purposes it is never necessary to instruct patients to write down their dreams during the night or even at the earliest opportunity in the morning. A dream which may be rescued from oblivion by this means is not likely to prove of any particular value in the task of clearing up the patient's condition. No special means for taking care of dreams are required. The dreams the patient remembers and relates spontaneously furnish the material needed for all practical purposes.

2. RUDOLF REITLER. Eine infantile Sexualtheorie und ihre Beziehung zur Selbstmordsymbolik. *Zentralblatt f. Psychoanalyse*, II., 1911, 114-121.

Reitler discusses the relations of suicidal impulse in the adolescent to the infantile sex theory of Freud in connection with the report of a clinical case which came under his observation,—a woman, 42 years of age, presenting as the most persistent and troublesome symptoms for which she sought psychoanalytic treatment, neurotic enuresis, excessive onanism, and extreme sleeplessness.

The first trouble was so severe that on account of it she was unable to travel, attend any society functions or even absent herself from home for any length of time. Her onanistic excesses were not accompanied by the usual sex phantasies or indeed by any sexual imageries. During actual sexual intercourse she remained frigid. To induce orgasm in herself on such occasions she had to contemplate in her phantasy a scene in which a man in the process of urinating played the chief rôle. Strong relations being thus established between this phantasy, or rather, the act it portrayed, and sexual satisfaction it was perhaps logical that the woman should resort to masturbation as a means of overcoming her urinary trouble.

Her sleeplessness was extreme and the author's analysis was directed especially to its solution because it was the most troublesome of the patient's symptoms. The patient believed herself extremely sensitive to noise. Accordingly, she had instituted all kinds of measures for the exclusion of sounds from the neighborhood of her sleeping room. The residence was chosen on a side street seldom visited by wagons, on an

upper floor. The rooms on each side of her sleeping chamber remained empty and securely locked up. The windows and doors to her room remained closed summer and winter, and all crevices and cracks were stopped up. Heavy portieres and curtains, cushions and carpets were distributed everywhere. But all these extreme precautions to deaden sound proved useless as she continued to pass sleepless nights. This condition of extreme sleeplessness had lasted for many years preceding treatment.

Under psychoanalytical inquiry it was soon found that not the actual perception but the fear of noise was what kept her sleepless through the nights. Under the extreme precautions she had taken she could have not been disturbed by the actual occurrence of sound. What really kept her awake was the thought that noises may occur and prevent her from going to sleep. Simple as this fact is, the patient, at first could not be induced to see the difference between actual noise and the unpleasant anticipation of it. Her manifest unwillingness to recognize this difference pointed thus clearly to a subconscious opposition against the discovery of the guilty psychic complex which lay undoubtedly hidden in this direction. This was only to be expected and served only as a sign that the inquiry was approaching the source of trouble. Patients always show opposition at such critical times. Their memory fails them or their understanding seems to be serving them poorly. The woman had been under psychoanalytical treatment long enough to understand the guiding principles of this method and was well aware at the time that if she acknowledged that not the noise but the fear of it kept her awake the next step would be to trace this fear back to some unfulfilled wish of a very intimate order. Naturally enough patients strive against being confronted with those innermost features of their psychic mechanism which are incompatible with the ethical and social standards forming the framework of ordinary conscious activity.

At this point the author suspected that there may have been a time, perhaps during her childhood, when the patient chose to lay awake nights in order to listen to some mysterious or pleasurable sounds of some kind. Later on, under the restraint of a consciousness dominated by the usual ethico-social ideals of conduct with which children become imbued she may have wanted to turn away from this shameful thing but the suppression of the effect was only partly successful even if the actual occurrence was completely rooted out from conscious memory. The accompanying affect, incompletely repressed, manifests itself now under a morbid form as fear. At first the patient denied every intimation along this line. Asked pointedly whether she had ever witnessed the sexual act among her parents as a child she did not fly at once into a defensive attitude, as subjects often do, forgetful of the maxim, *qui s'excuse, s'accuse*. Instead she couched her denials in temperate, well ordered language without undue protestation and without recourse to illogical argument to prove the impossibility of such an occurrence. In short, she did not protest too much. The manner of her denial was such that there was no reason to suspect the usual opposition which neurotics fling subconsciously across the examiner's road whenever his inquiries approach sensitive ground. It was clear that the patient had really not witnessed the sexual act among her parents as usually understood. What she did see, while a child, she could not tell, at least she remembered nothing of it at the time, but this came to the surface quite incidentally later.

Author and patient were conversing about suicide one day. She con-

fessed having at one time contemplated this act; she intended to use for the purpose her father's army revolver because, she stated, it symbolized more closely than any other means of self-destruction she might have chosen her return into her father's arms; also the man on whose account she was entertaining thoughts of suicide was an army officer, like her father, and this may have had something to do with her choice. That the patient was aware of the symbolic meaning of the pistol, in Freudian terms, at the time of this conversation, became evident by a remark she had made in the course of her story. But her suicidal phantasies centered much more persistently around illuminating gas. She liked to picture herself committing suicide by throwing the gas jet wide open. Much to the author's surprise, in relating this phantasy, the patient laid particular stress upon the noise of the escaping gas, although at the time she must have been equally aware of the symbolic meaning, of the gas pipe running horizontally from the wall over her dressing table. Questioned about this the patient retorted, not without a significant show of feeling, that it was the escaping gas and not the pipe which caused death. This was not satisfactory to Reitler. He remarked that the ball and not the revolver causes death, yet in relating that story she had laid all stress on the revolver. He undertook to explain the symbolism of escaping gas in Freudian terms and before he was through there came to the patient's mind a childhood recollection which had escaped her memory so completely that she had not thought of the incident in question even once in the thirty-five years since it happened.

She was about six or seven years of age at the time. One morning she wandered at a very early hour into her parents' bedroom and found them sleeping together. The lower part of her father's body was exposed naked. Much frightened she returned to her room, closing the door behind her so quietly that her parents knew nothing of the incident. She tried to fall asleep but could not. Instead she was thinking persistently of what she had just seen and also of the noise of escaping intestinal gas she sometimes heard from that room. As she lay awake reflecting on these matters she connected the two and gradually built up a whole theory about the manner in which "parents carry out that about which it is not the children's business to know anything." She thought of an apposition of the gluteal regions between parents in bed and an exchange of gases between them as constituting the sexual act.

This infantile sex theory had been completely forgotten. In later years it only appeared "affektdeterminierend" in the patient's suicidal phantasies in which the outrushing gas represented symbolically, according to the writer, the noise of the intestinal gases heard by the child in her parent's bedroom.

Further analysis disclosed a number of other phantasies and symbolic relations around the theme "gas, wind, storm=fecundation." For instance, as a young girl she wished for herself not a "deep and true" but a "stormy" love. Once, on a stormy night she experienced an unaccountable impulse to go into the street and wander about with her clothes loosened up about her so as to expose her body to the fury of the storm. She would thus catch cold and die of pneumonia,—an erotic phantasy masked under a suicidal impulse. In fact stormy weather always brought her enjoyment, "a pleasurable feeling akin to sexual delight."

Perhaps the most remarkable feature about the case is the fact that as soon as this infantile sex phantasy had been thus brought to surface and its rôle in the patient's condition explained to her, she was

completely relieved of her sleeplessness. She removed the unusual precautions against noise around her room and for the first time in many years she was able to sleep. She was even able, for the first time in twenty years or more, to renounce the use of antiphones, and ear stoppers and heavy bandages around her head. The other symptoms also showed a noticeable improvement. The recovery of sleep persisted through the interval between the solution of the trouble and the publication of the report, a period of about ten months. The belief seemed justified that the recovery was permanent.

The author quotes numerous references from comparative religion and folklore to show that, after all, the patient's peculiar infantile sex phantasy in which air, gas, or wind plays such a predominant rôle is not very unusual. In her childish phantasy the patient had built up a theory of fecundation the parallel of which is not uncommon in folklore and mythology. Even Christianity is not free of such phantasies. The bible mentions the appearance of the holy spirit, symbol of fertility, not only under the old phallic form of tongues of flame but also accompanied by storm or wind. The relation between the first breath and life is too obvious not to have been seized upon by the primitive mind; it furnishes a rich theme of phantasy and conjecture in folklore, both ancient and modern. According to a Brahmin belief, Prajapati animated man with his lower breath while his upper breath gave life to the deities. In Eduard Fuchs' *Illustrierte Sittengeschichte* (suppl. vol., p. 289) may be seen a reproduction of the portals of St. Mary's Church at Würzburg and over it will be noted a bas-relief representing "Mary's Conception." It shows God himself in the rôle of father holding between his lips "einen langen Schlauch" the other end of which reaches down to earth and enters the body of Mary. In the Finnish epic Kalevala, the virgin Ilmator is represented as becoming a mother through the agency of the wind. Such notions are common in the folklore of many people.

3. B. DATNER. Eine psychoanalytische Studie an einem Stotterer. *Zentralblatt f. Psychoanalyse*, II., 1911, 18-26.

Emboldened by Stekel's suggestion that anxiety neuroses frequently manifest themselves under bizarre and unusual forms, the author of this communication applied the psychoanalytical method of treatment to a case of stammering which had resisted all other methods of treatment. The success was so rapid as to appear truly marvelous. Although the case had been of many years' standing, only six days of analytical treatment were sufficient to accomplish a cure after years of special treatment by other methods had failed completely.

The patient was thirty-six years of age at the time of the analysis. He thought his condition was due to his being frightened by a large dog when he was about eight years of age. His mother attributed his condition to diphtheria from which he had suffered one year later. The process of analysis was begun without any unnecessary loss of time and proceeded rapidly as the author enjoyed the patient's complete confidence from the very beginning. Without this the result would probably not have been quite so prompt. As soon as the plan of treatment was outlined the patient plunged into the most confidential features of his personal life history, beginning with his earliest recollections. At six years of age he had already been addicted to masturbation; and he had attempted coitus-like relations with his sister, a little girl of four. Soon afterwards his sister died. It produced a painful impression upon him, and ever after the recollection of his deed

brought him many remorseful pangs. He was very pious; yet he did not dare confess to anyone his trouble; and this aggravated his mental condition. Though no one knew his secret, he feared that some day he would be found out and this would mean everlasting scorn and ruin. The memory of his nefarious act stretched like a red string through all the mazes of his life experience.

Here are a few examples of his speech trouble. In reading gender terms, *der* and *die* became *du*, especially when he failed to concentrate his mind upon the task in hand; *ihm* became *ihn*; and *ihr*, nearly always, *ich*. The patient recalled having had the same difficulty during his school period. His trouble evidently began with the pronunciation of particles of speech denoting gender. He confessed that particles like *der* and *die* reminded him of his early misdeed; and whenever they occurred in the course of his speech he faltered and stammered. Gradually the difficulty spread to many other words denoting gender until there was quite a constellation of them. Thus gender-bearing nouns became also the bearers of the secret of his soul and witnesses of his guilt. Every word denoting sex caused him to falter and stammer in his speech. All this was explained to him in Freudian terms and his conscience was assuaged and freed of the burden of self-reproach. The result was that the speech difficulty cleared promptly.

The word *anstossend* also presented difficulty. The patient invariably read this word *angestossen*. Questioned about this, he declared "*er hatte die Empfindung im Leben überall angestossen zu sein.*" With this explanation and the author's reassuring counsel this trouble also disappeared.

Under the circumstances it was only natural to surmise that a similar pathogenic memory-complex was at work behind every other word, whose reading or pronunciation presented marked difficulty. Consequently each important troublesome word was taken up in turn; its free associations, and the memory pictures it evoked were analyzed as minutely as possible. Here is an example: *Osterfeiertage*. The patient was able to pronounce this word only after several unsuccessful attempts. Asked about the memories which the word brought to his mind, the patient recalled, for the first time since he had grown up, a painful scene which he had witnessed as a four-year-old boy, on Easter day. He saw his father brutally attacking his mother for having dared to disobey his orders not to have anything to do with her sister who had given birth to an illegitimate child. He saw himself kneeling at the feet of his dearly beloved mother while his father was heaping abuse upon her; and he experienced once more, almost in its original intensity, the hatred of his father which that painful scene had originally evoked. He could still recall the unspeakable epithets and insults although more than thirty years had elapsed, and he had never thought of the sad occurrence in the meantime. The dramatic intensity of the situation was heightened by the fact that he was very much attached to his aunt, an affection which was not without its sex elements, according to the patient's own spontaneous avowal. Also, throughout his life, the patient was extremely devoted to his mother, while towards his father he felt an equally strong repulsion.

A number of other confessions follow, pertaining mostly to the patient's numerous love affairs and his intimate sex experiences. Some of his amorous adventures were carried out under circumstances which weighed heavily on his conscience later. He worried over them, felt he had done wrong and, being of a religious disposition, he feared that punishment in some form would reach him sooner or later.

The lengthy confessions over, the author explained point by point the relation of the various memories recalled to the patient's symptoms and appeased his conscience with proper reassurances. After one week of this treatment, as has already been stated, the speech trouble was overcome completely.

4. N. VASCHIDE. *Le sommeil et les rêves*. Paris, 1911, 305 pages.

The author of this work had published at various intervals since 1898 a number of papers on sleep and on dreams. After his death, in 1909, his papers were gathered together, and they form the present volume in the *Bibliothèque de la philosophie contemporaine*.

These papers fall into three groups. The first group deals with the subject of sleep proper, and outlines the various hypotheses which have been proposed, notably the circulatory, neuro-dynamic, biochemical, toxic and biological theories. The psycho-physiology of sleep and the rôle of attention are also considered briefly. The second group, also historical and expository, deals with dreams and especially with the experimental sides of the problem. Here are recorded the well-known theories of Maury, Marquis d'Hervey de St. Denis, Mourly Vold and Freud, as well as the particular technique of inquiry upon which these theories are based. The author's own observations and technique are given in the third part. Interesting as they are, most of these observations are not empirically established. When we are told, for instance, that a determination to awaken at a certain hour disturbs sleep and usually leads to one's awaking earlier than the set time we must regard it as an empirical statement, although the author does add that during a sleep from which we wish to awaken at a certain time there is an acceleration of the cardiac beat. We are also told that dreams are lighter and more logical during day time than at night; that the structure of a dream is related to the depth of the sleep; but these are well-known facts.

The commonly accepted belief that 'thoughts fly faster during sleep' is doubted by Vaschide. He claims to have found that a brief period of amnesia occurs immediately upon awakening; it occupies an interval of one-tenth of a second to two or three minutes. This discovery should prove of highest importance in the study of dreams if it can be substantiated. The recollection of a dream within a dream is ascribed to autosuggestion. The volume contains no other suggestions strikingly novel or original. Even the notion of a brief amnesia between the sleeping and the waking state is not new. Vaschide's merit in its connection consists in furnishing, apparently, scientific evidence or sanction for this old belief.

The 'conspiracy of silence' which, according to the plaint of his pupils, surrounded Freud's *Traumdeutung* is certainly at an end. Freud's work is given a prominent place in this volume. Vaschide ranks it, with the work of Maury, as the most systematic and thorough inquiry into the realm of dreams. Vaschide makes a great deal more of Maury's theories than the facts warrant. This may be easily explained as an instance of French bias, perhaps brought about logically enough through Vaschide's greater familiarity with the literature of his adopted country. Maury did not formulate anything like a complete fundamental theory of dreams, such as Freud's. His chief merit lies in a number of keen observations, but they are far from forming a complete system. We learn from Maury, for instance, that olfactory dream hallucinations are especially common in the prodromal stages of psychoses. Nothing more is said about this matter. A similar

observation by Freud, namely, that the olfactory sense is abnormally developed in neurotics (in his *Bemerkungen zu einem Fall von Zwangsneurose*) is explained by reference to a well-ordered system of psychological notions.

Diametrically opposed to Maury's position that dreams are the product of psychic automatism stands Marquis de St. Denis, another French writer of whom Vaschide is disposed to think very highly. The somewhat eccentric work by St. Denis entitled, "Dreams and How to Control Them," embodies some very ingenious observations, but unfortunately their value is considerably lessened by the circumstances under which the observations were made. The author was interested in finding a method of controlling dreams. The objectivity and accuracy of his observations must have suffered in consequence. Vaschide is convinced that we cannot so much as control the hour of awaking without interfering with the course of dreams; and in a work like that of St. Denis, undertaken with the avowed purpose of finding a method of controlling dreams, it would be difficult to overestimate the influence of suggestion.

But "Dreams and How to Control Them" is not without its merits. It is one of the first works conceived in a scientific spirit which starts with the premise that there is method and meaning to every dream, no matter how complicated, and that we ought to bend our efforts to understand dreams as a peculiarly suitable means of getting at the workings of the human soul. In fact, its author went so far as to maintain that the true character of persons, especially of women, may be perceived more correctly through the understanding of dreams than through a knowledge of their conscious activity. While St. Denis has framed no such fundamental conceptions as Freud's *Traumdeutung* the merit of having anticipated some of its important conclusions belongs to him.

No review of a work on dreams would be complete nowadays without a reference to the author's attitude towards Freud's theories. Vaschide's account of them is sympathetic so far as it goes. Strange to say, in this account the sexual factor is hardly given the import it bears in the original theory. A dream of Ernest Renan, dating from the early sixties, is rescued from the forgotten pages of literature and is psychoanalyzed, but incompletely. The author regrets that Freud's *Traumdeutung* is not better known in France.

5. JOHN MOURLY VOLD. Ueber den Traum: Experimental-psychologische Untersuchungen. Herausgegeben von O. Klemm. Leipzig, Barth, 1910, 435 pages.

We are witnessing an almost unprecedented revival of interest in the subject of dreams, judging by the number of books that have appeared recently on the subject. Certainly not since the early sixties have there been published so many works on the subject at any one time. True, most of these works consist chiefly of historical accounts of the problem; they furnish excellent general surveys and add little that is strikingly new to our knowledge; but there are a few notable exceptions, especially among the books dealing with the experimental side of the problem. Among the latter, Mourly Vold's work deserves to be singled out as perhaps the most thorough and painstaking. It is based on personal observations carried out by the author over a long period of years, also on the observations of a number of students under his direction; and the work is a fair example of scientific perseverance. The results obtained by the author may be adjudged rather scant when

contrasted with the amount of labor they have cost but this only adds to the merits of the author who has chosen such a thankless field for his scientific labors.

A review such as this work deserves would be out of place here; only a few points of special interest from the Freudian standpoint of dream analysis will be noted.

Vold found that in dreams facial hallucinations may be due to sensory stimulation of other bodily regions, just as in the waking state. Any cutaneous-motor stimulation, no matter on what portion of the body it may be located, may give rise to facial hallucinations. These hallucinations are more frequently caused by such peripheral stimulations than by excitations of facial regions directly. In other words, stimuli involving directly the retina or ocular muscles or other portions of the ocular apparatus play only a secondary rôle in the psychogenesis of facial hallucinations. Between the facial hallucinations in either dreams or the waking state and the facial and other hallucinations of psychopathic states there exists, according to this Norwegian writer, a very close psychogenetic relationship. Freudians who have been criticized severely because of their tendency to apply the psychic mechanism revealed in morbid states to the analysis of normal psychic activity will welcome this view as implying a vindication of their position.

Another of Vold's conclusions which will be greeted with a great deal of satisfaction by the pupils of Freud is that concerning the origin of dream hallucinations. He finds that these are frequently built around childhood memories. For the explanation of hallucinations during which objects are seen moving passively through space Vold assumes a special psycho-motor state, a generalized feeling akin to sexual excitation. This is particularly true of the state accompanying the vision of things swaying in space and of dreams in which one finds oneself floating along smoothly or flying through air. Sexual excitation manifests itself in dreams and hallucinations through a peculiar state of muscular tone; it gives a feeling of strength, of muscular vigor and of general well-being not easily described. This is the reason why such dreams are most common during puberty. They are often encountered also during convalescence from disease with the return of the patient's strength and vitality. The paintings representing saints in a state of ecstasy, and many of the so-called spiritistic phenomena belong to this category. Witches and charmers who are represented as riding through space, etc., are hysterical subjects with strong sexual leanings.

6. L. LOEWENFELD. Ueber die Sexualität im Kindesalter. Sexual-Probleme, VII., 1911. 444-454; 516-534.

Loewenfeld was among the first writers to oppose Freud, in the middle of the nineties. Unlike others, he did not attack psychoanalytical views in a prejudiced spirit but on the basis of counter-proofs and with scientific arguments. This makes him an honorable opponent and renders his views particularly interesting.

The present contribution is a brief discussion of Freud's theory of infantile sexuality as developed in the *Drei Abhandlungen zur Sexualtheorie*. He wonders how Freud conceived that *das Ludeln* is always an occasion for sexual excitation in children or that onanism is a universal trait of infancy. According to his observations upon children this is not the case; nor are pollution-like excitations as common among children as is maintained by Freud's school.

Concerning the inclination of children to uncover themselves, Loewenfeld states that it is by no means a universal trait, nor need this tendency of children be interpreted in the same sense as the more significant forms of exhibitionism. Why would it not be more simple and equally satisfactory to look upon the tendency of children to uncover themselves as due simply to the pleasurable feeling which freedom from cumbersome coverings naturally gives? In the same way their 'exposure' instinct may be explained without recourse to any fanciful theory as due to the children's natural learning instinct and great curiosity. These traits are universal enough so that it would not be far-fetched to ascribe to them the tendencies which are characteristic of childhood instead of having recourse to very elaborate hypotheses. Children are naturally curious about everything that comes within the reach of their senses. What is more natural than that they should extend the same curiosity to certain regions of their body? Even a certain degree of 'exhibitionism' would be admissible on this score, and would not necessarily imply erotic tendencies.

As to fear, it is by no means certain that it stands in such close relationship to sexuality as Freud would have us believe. Infantile fear may be only the natural consequence of ignorance, the realization of complete helplessness in the presence of the unusual. Freud assumes that the erogenous character of the excretory zones of the body is realized early during infantile life; but Loewenfeld denies that this is frequently the case. According to the latter's experience with children, the erogenous character of these zones may not become manifest earlier than the school age, and even then, the sexual awakening may proceed without any of the portentous consequences described by Freud.

The infantile "*Analerotik*" which, according to Sadger, is the most common form of sexuality in childhood is looked upon with extreme scepticism by the writer.

7. P. NÄCKE. Ueber tardive Homosexualität. *Sexual-Probleme*, VII., 1911. 612-634.

Under 'belated' homosexuality the author conceives the homosexual tendencies which appear late in life in persons who have first experienced hetero-sexuality, or bi-sexuality with the hetero-sexual component predominant.

The author thinks that genuine cases of this kind are rare. The subjects belong to the group of bisexuals. Homosexuality cannot be aroused through improper associations, lewd suggestions of corrupt companions, like other vices; homosexuals are born, though the trait may appear only late. There is no such thing as acquired homosexuality. Most cases which manifest themselves late in life are instances of 'pseudo-homosexuality.' True homosexuality breaks out early. The best guide to a differentiation between the two forms is furnished by the subject's dream life.

These are in brief the author's views on the subject. The case which furnishes this opportunity of discussing them is one of infantile repression, in Freudian terminology. Of course the subject was bi-sexual; the analytical school of psychology recognizes no alternative. It looks upon mono-sexuality as a myth. With the author's view that homosexuality does not necessarily imply degeneration, Freudians will agree; but they will probably refuse to accept the new term which Näcke introduces. What is there really to distinguish his 'belated' homosexuality from the ordinary form? The time of outbreak of a homosexual trait

does not create a new type. Even the term 'pseudo-homosexuality' is of doubtful clinical value. Moreover, its introduction weakens the author's views concerning the psychogenesis of these sexual traits because it implies a serious contradiction. Nothing can be gained by making such hair-splitting clinical distinctions.

8. A. J. STORFER. Zur Sonderstellung des Vatersmordes. Eine rechts-geschichtliche und völkerpsychologische Studie. *Schriften zur angewandten Seelenkunde*, No. 12, 1911, 34 pages.

Storfer's study of patricide is an application to social psychology of some of the fundamental psychoanalytical principles. It starts with a brief historical account of the development of the notion of crime as a social concept. The author's standpoint is that hunger and love have been the two dynamic agencies which have shaped all associations between men from the earliest hunting groups on, including all family ties. The endeavor to satisfy the primal instincts as thoroughly as possible required a certain economy of action; and this introduced the principle of personal sacrifice for the greater good of all. The passing of the stage which may be described as having been characterized by the *homo homini lupus* rule of action over into a condition in which man learned to act as a *ζῷον πολιτικόν* brought about a certain limitation of personal freedom. The majesty of 'self' was counterbalanced by that of the almighty 'we.' As the various principles of utility shaped themselves the social requirements predominated, and acted as a safeguard against the more circumscribed selfish motives of the individuals as such. Any deed which was deemed by the majority of the group, consciously or otherwise, as detrimental became unsocial and was branded with some distinctive term denoting disapproval, irrespective of individual regard or interests. We have not as yet realized in practice an ideal concept of crime based on the broadest social significance of the term. This remains to be accomplished by an order of society to which true eugenic ideals will be more fundamental as guiding principles than they are in our present social organization.

The old notion that primitive people obeyed commandments and avoided crime because this was in accord with divinely prescribed law has been entirely exploded. Modern science has replaced it with the conviction that every juridico-social or religious proscription was, at bottom, only the projection of some human wish, and embodied the expression of the dominant interests of society at a certain stage in its evolution, such as the family, the group or clan, the caste, the city, the nation or state. Thus legal and religious beginnings have a common history.

Mythology represents the fossilized remains of a social and ethical order whose characteristic traits are older than any period of which we possess distinct historical records. Through the study of myths and primitive religion we learn something about the ways in which our earliest ancestors thought and acted. It was therefore a happy thought to call mythology the palæontology of ethics.¹ The historical value of legends and myths may be small if one considers only the incidents recorded therein as such, but for the reconstruction of old beliefs and ethico-social ideals they furnish an unlimited wealth of material, as has been pointed out, among others, by Bernhoft.² This is especially true of mythological data.

¹ MAKAREWICZ, *Einführung in die Philosophie des Strafrechts*.

² *Ehe und Erbrecht d. griech. Heroenzeit*, *Zeitschr. f. vgl. Rechtswiss.*, XI, 322.

A definite conception about religious beginnings must precede any attempt at interpreting the inception and evolution of ethico-legal notions and ideals. If one admits, with Bastian for instance, that the psychological source of religion is fear,—the fear of the many demoniacal powers with which primitive man must have thought himself surrounded,—then one may accept without question the hypothesis that flows from it that “*das Mordverbot sei eine naheliegende Rückwirkung der dämonischen Bevölkerung der Natur und der dämonisch bereits empfundenen Zustände des Seelischen.*”^a But the author of the present study points out that, among primitive people, fear of demoniacal powers and fear of murder are by no means parallel developments. On the contrary, the killing of an enemy is a virtue, which like many another, springs from necessity. What is more, among some primitive people whose struggle for survival was particularly severe on account of the meager means of subsistence available, economic necessity developed the custom of killing off the old and feeble. In the same way we must look to economic and other social-utilitarian causes for an explanation of the earliest religious and juridical customs and beliefs.

Freud, in recent years, has emphasized again the analogies between individual psychic activity and the mechanism of social psychology and has contributed to the subject a wealth of suggestions, most of which remain as yet to be worked out. In one of his minor contributions entitled “*Zwangshandlung und Religionsübung.*”^a Freud states: “*Ein fortschreitender Verzicht auf konstitutionelle Triebe, deren Betätigung dem Ich primäre Lust gewähren konnte, scheint eine der Grundlagen der menschlichen Kulturentwicklung zu sein.*” This is in accord with the well-recognized fact that even the earliest forms of religious customs imply a certain sacrifice of individuality. It shows, in general traits, the psychic factors at work in the process of crystallization of religious beliefs. Consider, for instance, the custom of setting aside a portion of land for the use of divinities and the rich gifts and sacrifices to invisible gods while the community is carrying on a precarious existence. These illustrate the inhibition of selfish instincts and show how broader principles of sacrifice to ‘higher duties’ are introduced.

The heroes and divinities of mythology are surrogates of the people's suppressed wishes and phantasies. Religious traditions illustrate the hidden mechanism of the social mind. This explains why the life histories of heroes and of divinities are rich in unethical incidents and plots of a repulsive nature. Wundt^b states that ‘objectification of the people's own consciousness’ is the source of all myth-formation, and that in this process man shifted all his qualifications, even the worst, greatly magnified, upon divinities created for this purpose. The analytical psychology of Freud substitutes for Wundt's objectification of consciousness the ‘creative power of subconsciousness,’ and maintains with particular stress that no magnification of any traits occurs in the process. The traits ascribed by man to his god, from the best to the very worst, are those which live in his breast, either as remnants of his long past or as aspirations of his own future. In the psychic mechanism of the individual Freud has found that the unwelcome, forbidden wish is transposed and sometimes projected outward and upward. A study of myths and religions shows that the same mechanism is found in

^a BASTIAN, *Zur Mythologie und Psychologie der Nigritier*, p. 160. In this connection, ‘*dämonische Zustände*’ refers particularly to dream and disease.

^a *Sammlung kleiner Schriften*, F. Deuticke, Wien, 1909.

^b *Ethik*, 3rd ed., I., 52.

folk-psychology. Not only do religious commandments and proscriptions represent what is socially undesirable at a given stage in the evolution of society, but the life histories of all religious heroes, from the earliest mythological divinities to Christ, show a transfer 'upward' of what is incompatible with man's sophisticated notions of morality and is therefore forbidden. Consider, for an example, the following instance: People living in an order of society in which the family organization is basal and the powers of the *pater familias* supreme, look upon patricide, naturally enough, as the blackest crime of which one could be guilty, yet they are the very people who represent their divinities as guilty of it.

It appears that among primitive peoples individual life was not valued highly. In a state of society in which war was of perpetual occurrence murder could have not been a very serious offence. Where enemies abound and the struggle for survival is at its keenest, killing in order not to be killed is a necessity. Even before the Marxian materialistic conception of history was formulated, the view was expressed by no less keen an observer than Voltaire, that war was at bottom a question of theft.* The occasional snuffing out of a human life could not have been looked upon as a very portentous affair in those unstable days of continuous warfare. The bellicose disposition of primitive people is further illustrated by their well-known mistrust and suspicion of all strangers. There is a deep psychic reason for this. Subconsciously, if not otherwise, every stranger is regarded as an eventual competitor in the struggle for existence or as a possible sexual rival. These are the two greatest motivations of man's earliest struggle on earth; and they have remained largely so to this day. It is interesting to note that a similar subconscious motivation has been ascribed to the child's instinctive dislike for or fear of strangers, and to the similar peculiarities of mental defectives. Their otherwise unaccountable mistrust varies, as is well known, from slight antipathy to marked hatred and a desire to kill the stranger. The friendly reception of strangers is a late development in the evolution of men's relations with each other, a distinct mark of sophistication. It was a natural sequence of the development of commercial exchange and similar pursuits. With the custom of exchange the first substantial step was taken towards the internationalization of law; it marked the beginning of the transfer of *hostis* into the quality of *hospes*. Indeed, it is not by accident that the words *host* and *hostile* are traceable to the same root. This change had a tremendous influence upon the course of social progress. For one thing, it introduced, besides the notions of 'I' and 'we,' a third, 'host,' belonging to the same category. Henceforth a host could also enjoy certain rights and privileges in the midst of the social group; not all strangers were alike enemies.

The principle of unlawful murder within the community must have been introduced by way of contrast between the rights and privileges of the 'classes' or categories mentioned. If the *host* appeared in the quality of *hostis*, or was adjudged thus, during turbulent days of warfare and reciprocal suspicion between allied groups, it was no doubt proper to kill him. But the sanction of the group probably did not extend to the murder of other members within it, except, of course, in those instances where lack of food supply or similar conditions made the removal of such unproductive members as the old and the feeble a desirable measure of relief and the custom of killing them off grew

* This expression was paraphrased by Proudhon in his famous definition of private property: '*La propriété c'est le vol.*'

as an ethico-religious ceremonial. But there was one form of murder which must have been guarded against by all the means at command in those days, namely the killing of the chieftain, the man in whom centered all the social authority, all the power and prestige of the group. An attack upon him meant an attack upon the whole community; it savored of a social calamity. Such a crime must therefore have stood out as the blackest imaginable. The deed was nothing short of treason. To this day, treason is still the highest crime of which a man may render himself guilty, and it calls forth summary punishment. Garofalo calls it the natural crime. The moral difference, where the physical deed was similar, must have been perceived in some way even by those primitive men to rest in the relations between the agent of the crime and his victim. In that stage of society in which the family was the social unit, forming a sort of state on a small scale, and the larger community was but an aggregate of such states, with the father in each as the head, rebellion against him must have been looked upon as the equivalent of political treason and patricide must have been of all forbidden deeds, the vilest crime. Even after the family ceased to be autochthonous and was succeeded by other forms of social order, the old odium attaching to patricide must have survived in folkthought, especially in communities, like Rome, in which the family continued to be, in many respects, the basis of the whole social organization.

With the *pater familias* representing the powers of the state and patricide political murder *par excellence*, the killing of the father, was probably the first publicly forbidden form of murder. History, archeology, ethnology, jurisprudence and the psychology of the subconscious mind of childhood bring evidence from widely separated fields substantiating this point. The particular forms of prohibition and the formulation of preventive and punitive measures can be understood only in connection with the economic and other social conditions of the respective people, and on the basis of analytical psychology.

Two very significant facts may be mentioned as illustrating these principles and their wide range of application, when considered in conjunction with each other. Among the earliest politico-religious regulations of the Babylonians, Assyrians, Egyptians, Greeks, Romans and Chinese alike (and almost every other nation that might be mentioned) we find specific and unusually severe punishments provided for offences against the head of the family, that is, the father. On the other hand, it will be found that the gods of all these nations have been represented as guilty of all kinds of offences against the father, including murder. Moreover, there are legends among many Indo-European peoples of occurrences in which the son drove the father from the seat of power in the family and usurped his place. The most precious possession that went with the coveted place was woman. Nor is it easy to distinguish between the chief wife, the concubines and the slaves of those times. At any rate, among the Indo-Europeans it was not uncommon for the son to inherit his father's concubines and women slaves, even if traces of his marrying also his father's chief wife, that is, his mother, are not so frequent. Certain it is that among the Lithuanians and Prussians, for instance, the son was not forbidden to marry his step mother and this custom of intermarriage between children and foster parents was also known among the Anglo-Saxons.

Thus yearning after power and particularly for the sexual privileges which it brought were the psychic motives which led to patricide in the early cultural states of society. Kohler¹ makes a comparison which

¹ Holendorfer-Kohler, Enzyklopaedie, I., 6.

throws a flood of light on the biológico-psychic origin, import, and consequences of changes in social control when he states that "*Jedes Recht ist ein Oedipus der seinen Vater tötet und mit seiner Mutter ein neues Geschlecht erzeugt.*" Kohler's reference to the Oedipus myth was incidental; but the analytical psychology of Freud insists that it is more than a figure of speech. That it embodies a literal truth. The Oedipus myth represents the incest phantasy of a nation, and is a paradigm which furnishes an important starting-point for the psychoanalysis of the relations between children and parents. "Many men there are," runs a remarkable statement in the Oedipus tragedy by Sophocles, "who have seen themselves in dreams mated to their mothers." Thus incest phantasy is openly recognized by the Greek mind. The plot of Shakespeare's Hamlet is also believed to rest upon an incest phantasy.*

The rivalry between father and son, the young hero and the ugly king, furnishes the plot for many myths and folk-stories among the most varied nations. This is only natural to the naïve mind of primitive people since the patriarchal family-state was not the earliest form of family organization. It was preceded, as is well known, by hetærisms (promiscuous, or clan marriage) and by the matriarchal form of organization. No wonder that incest phantasies are universally distributed and regularly projected or transferred by the people to their deities and mythical heroes. Every one is familiar, for instance, with Caesar's statement about the Britons, in his *De Bello Gallico*: "*Uxores habent . . . inter se communes . . . parentes cum liberis.*" This promiscuity was stopped only by the advent of the patriarchal form which also led ultimately to monogamy. But such a radical change in the sex relations between the members of the family or clan, was not possible without strong psychic repressions. Custom and law, religion and superstition enforced the new order and added force to the psychic repressions. One of the formal results of this was that members of the families became sophisticated; filial piety, especially toward the father, came to be looked upon as a particular virtue. Still, early infancy is free from it, for, as Lafontaine has said, "*cet âge est sans pitié.*" According to certain recent Freudian deductions, this should be found to be true also of the early age of nations.

In the patriarchal state the manifest glory and power of the *pater familias* consisted chiefly in his sexual privileges; these, at an earlier period, had been shared by all the adult males of the family more nearly alike, hence the sense of rivalry between father and son, hence the incest phantasies, the symbolism of childhood, the dreams representing patricide. Hehn's report in his "*De moribus Rhutenorum*," of a young man who told with considerable pride that his bride had been rendered pregnant by the Batjuschka, the master, his father, is very significant because it throws additional light on some possible privileges of the *pater familias* during the patriarchal state and indicates his absolute powers. It is quite possible that the land master's much discussed *jus primæ noctis*, during the later, feudal-economic state, may have been a remnant of the original privileges of the *pater familias*. Indeed the land-lord exercised the same absolute rights over his community as the *pater familias* of old over his circle; in a certain sense his was a makro-family over the members of which he held the same despotic powers.

* "*Hamlet ist ein Eckpfeiler in der Entwicklungsgeschichte von Recht und Sittlichkeit.*" Kohler, Shakespeare vor dem Forum der Jurisprudenz, p. 180. See also Ernest Jones, Das Problem des Hamlet und der Oedipus Komplex.

It is interesting, in this connection, to note that *pater* and *πατήρ* mean originally the master, he who nourishes, and not father in the modern sense. This may be seen further from the relation of this term to *poteestas* and *δεσπότης*; In other words, during the patriarchal family organization the biological rôle of fatherhood was rather obscured by the juridico-social function. The master and head of the family was surrounded by special protective regulations, under the sanction of custom and religion. These were measures of state, directed against treason within the social body. It is extremely characteristic that *ἄγος* treason is the very term with which Kreon brands the action of Oedipus who kills his father and marries his mother.

If we turn to modern political crimes, plots, treasons and regicides, we find a strong and hitherto unexplained connection between the sexually motivated family conflicts and strife on the political field. Let this example suffice: One of the greatest epidemics of political murders in modern times was that which accompanied the rise of Russian nihilism. All the authentic documents that bear directly upon this movement indicate that it was as much a rebellion against old family conditions as against the old form of government. Turghenieff wrote a novel which was the first to give expression to the nihilistic tendencies of his day. In fact this is the work in which the word nihilist occurs for the first time. The Russian revolutionary youth borrowed from this novel the term which they applied to themselves and their movement. The title of this novel is '*Fathers and Sons*.'

Roman Patricide. The oldest Roman document referring to murder is the statement by Numa Pompilius: '*Si quis hominem liberum dolo sciens morti duit, paricidas esto.*' Why a murderer should be thus branded as a patricide is a problem which has led to endless controversy. A review of the etymological discussion of this expression, supplemented by an analysis of what historical documents are available, leads Storfer to the following conclusion: In the earliest times patricide probably meant the killing of any member participating in the sexual life of the social group; in patriarchal times this term was restricted to the murder of the head of the family; since Numa Pompilius it was again broadened to include the murder of any free citizen; and after the Roman republic it was once more restricted to mean the assassination of blood relations.

Animal symbolism in the Roman ritual of punishment for Patricide. For patricide, occasionally for the killing of other blood relations, the traditional punishment towards the end of the republic at Rome and during the imperial age was the *poena cullei*: the murderer was sewn up in a sack together with a cock, a dog, an ape or a snake and thrown into the ocean. This curious custom points to an early sexual implication of the offense. It is no doubt a survival of the early period when the sex factor was preëminent in the motivation of the deed.

It is well known that punishment and sacrifice, legal ceremony and religious symbolism, stand in very close relationship, having had a common origin. The Latin term *supplicium*, for instance, means *sacrifice* and also *capital punishment*. Every punishment is a ceremony motivated formally by the desire to appease the wrath of some deity who may have been offended through the deed but the ceremony also roots psychically in a deeper motive, namely, the satisfaction of the punishers themselves who in this manner abreact their own pent-up feelings. The ceremony, whether sacrificial or punitive, whether religious or legal, has the same object from the standpoint of social psychology, namely, the reëstablishment of psychic equilibrium. The cere-

mony is as complex and as impressive as the repressed phantasy complex to be abreacted is strong and deeply rooted.

He who kills his father is thrown into the ocean so that he may never reunite himself with mother earth, after being first sewn up with a dog, cock, ape or snake—symbol of the sexual import of his deed. Every one of these living creatures stands for sexuality in folklore, myth and religion. Storfer quotes numerous references from these three sources to illustrate this point. He concludes as follows: "*Dadurch, dass Hund, Hahn, Affe, und Schlange mit dem Vatermörder ins Meer geworfen wurden, dadurch, dass ihre Vereinigung mit der Muttererde verhindert wurde, sollte also die Empörung gegen die patriarchalische Gewalt, die Auflehnung gegen die sexuelle Omnipotenz des Vaters, der psychologische Rückfall in den Hetärismus gerichtet und gesühnt werden*" (p. 33).

9. F. WITTELS. *Tragische Motive: Das Unbewusste von Held und Helden*. Berlin, E. Fleischel & Cie, 1911, 165 pages.

In such works as Abraham's *Traum und Mythos*, Rank's *Geburt der Holden*, Ricklin's *Wunscherfüllung in Märchen*, and Storfer's *Sonderstellung des Vatermordes*, the results of Freudian analysis of the mechanism of individual psychic activity are applied to the study of phenomena of a psycho-social order. This is done on the reasonable assumption that the working order of the 'social mind' is at bottom governed by the same rules as the mind of the individual.

The present work by Wittels, author of the excellently written volume entitled '*Die sexuelle Not*,' represents a similar attempt to apply the analytical data of Freudian psychology to the field of letters and specifically to the motivation of dramatic plots. Wittels starts from the premise that the transfer of affects is a most common psychic occurrence. He also accepts the whole Freudian notion of the subconscious. With these two hypotheses as a basis, he formulates a rule which is to explain the psychic motivation of plots, practically as follows: The cause of all tragedy is the break into consciousness of the illogical and unethical subconscious self.

This broad generalization is illustrated and reiterated by references to many of the world's best known literary and dramatic plots. Brutus kills Caesar not on account of his great love for freedom, but because of his subconsciously acting hatred towards his father, his sexual rival, his mother's 'betrayers.' Rhodope condones the killing of Kandaules and then dies. The apparent reasons for this tragedy are humiliation and revenge. But psychoanalysis alone reveals the true reason: Kandaules became the surrogate, the bearer of Rhodope's subconsciously motivated phantasies and wishes. His death symbolizes her realization that she must part with them; hence his murder and the true motive for the tragedy. In like manner is to be explained Kandaules' act of exposing Gyges before his wife. Kandaules does this not out of sheer recklessness; he is led to the act by motives which he himself does not realize. The truth is that his wife had lost all charm for him, and Kandaules was prompted subconsciously to create an embarrassing situation for her,—a situation that may prompt her to commit a serious breach of marital ethics and furnish him with grounds for separation. Medea kills her children; again the formal reasons appear to be jealousy and revenge. But the real, subconsciously active, psychic motive is Medea's wish to be once more as young, pretty and attractive as when Jason first knew her. Why are such men as Macbeth attracted to women like Lady Macbeth? Because men who, for any reason, have

subconscious inclination to murderous deeds are always attracted by women capable of fanning their hidden tendencies which clamor for expression into an uncontrollable impulse so as to become abreacted. Such women as Judith, Charlotte Corday or Joan of Arc are impelled to deeds of heroism by suppressed erotic impulses. The political and patriotic reasons are merely formal. The true motives are hidden deeply in the subconscious. In the same way, religious devotion and saintliness are but a veil for latent sex impulses, a mask under which these are given free rein.

These and similar explanations are some of the consequences of the author's generalization. It will be seen that his formula is broad enough to be applicable to every known plot in the world's literature; but it may be that its very breadth divests it of concreteness. Moreover, the rule is applicable only in the presence of morbidly intensified psychogenic complexes. That is, we must first have the annoyed husband, the hysterical, love-longing wife, the Oedipus-complex, before the rule works. It would appear that after all, this formula is but a restatement, in hypothetical terms, of certain facts which had hitherto been stated in language more appropriate to their formal aspect. Whether anything is gained thereby and particularly whether any real light is thrown upon the psychogenesis of dramatic plots by this theory the reader must decide himself from the outline which has just been given. The reviewer's attitude remains 'rein referierend' for the present.

The reader may raise the question: Are we to infer that it is the dramatist's intention to depict that which Wittels sees in his creations? Or is Wittels' merely a view-point from which we may encompass the whole field of drama, irrespective of the dramatist's intention? In the last analysis it really does not matter one way or another. The dramatist is a man of deep vision, not a scientist; he may have been led subconsciously to depict struggles and situations whose real import escapes even his understanding. This is not uncommon. But whether this be so or not, the value of the dramatist's works as documents for psychoanalytical study remains the same.

A special chapter entitled "Hellas und Hysterie" discusses the problem as to whether the Greeks of the classical period were subject to hysteria. This chapter contains very excellent suggestions. The question itself is answered in the negative. The author states that the Greek theater alone provided a thorough channel for discharging pent-up subconscious motivations and was enough to keep the Greek mind in a healthy state and specially free from hysteria. For the Greek the stage was '*ein Hort der psychischen Gesundheit*,' a most precious safety valve such as the modern citizen scarcely possesses. It is a mistake to look upon the Greek drama as at all symptomatic of the Greek mind. On the contrary, it shows what the citizens of Greece escaped just because they possessed this means of abreacting their phantasies. We are inclined to look upon Greek tragedy as peculiarly strange. The unfamiliarity of its spirit is due to the fact that we are too much addicted to hysteria, '*wir leben mit ihr in Symbiose*.' Having succeeded in suppressing all unwelcome instincts far beyond easy recall, the heroes of Greek tragedy, bearers of our own subconscious motivations though they be, appear nevertheless to be strange creatures with whom we have nothing in common. As a matter of fact, if we were as frank a people as the Greeks were we should recognize a great part of ourselves in the heroes of their drama. A true understanding of drama is furnished only by the sympathetic rapport between the sup-

pressed longings and phantasies of our subconscious stream and the heroes of the stage. Every great tragedy represents before our eyes the demons of our inner self; and it is for us to be honest enough to recognize our identity with them. Therein lies the true appreciation of drama, the great virtue of the Aristotelian principle of aesthetic catharsis. But having become more and more interested in the formal and conscious side of our existence and having therefore wandered away from our inner self we moderns lack the clear understanding of the human soul which distinguished the naïve Greek mind; hence our inability really to appreciate Greek tragedy. Our civilization has carried us far away from that state in which man realized himself as a child of nature. We have become too sophisticated. This is the reason why the Greek stage seems no longer to hold up the mirror of nature to us.

A NOTE ON THE DETERMINATION OF THE RETINA'S SENSITIVITY TO COLORED LIGHT IN TERMS OF RADIOMETRIC UNITS

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About a year ago¹ the writers undertook to determine the retina's sensitivity, relative and absolute, to colored light in terms of units that can be compared. Since several years will be required to complete this work, they have thought it best to publish a preliminary note showing briefly the purpose and scope of the investigation. The following points will serve to indicate what is being attempted in this study.

(1) All measurements of sensitivity will be made in radiometric terms. This will give an expression of the sensitivity of the retina in units which are directly comparable with one another. At present we have no direct estimate of the comparative sensitivity of the retina to the different colors further than is expressed, for example, by the relative width of the collimator-slit that has to be used to arouse color sensation when a light-source of a given candle-power is used. This kind of comparison is obviously unfair because such different amounts of energy are represented from point to point in the spectrum that a given width of slit would admit many times the amount of energy at one part of the spectrum that it would at another. In short, no adequate estimation and expression of the retina's sensitivity to color, comparative or absolute, can be made by means of the methods now in common use.²

¹ The first public statement of our intention to use radiometric units in the investigation of the retina's sensitivity to color was made to the committee in charge of the Sarah Berliner Research Fellowship, February 1, 1911.

² Two criticisms have been received from private sources which it may be well to take account of here. In one the possibility of a point of view is implied, in the other a point of view is stated. The point of view, the possibility of which is implied in the first criticism, is that it is not proper to estimate the sensitivity of the retina in terms of physical units, because it is generally conceded by modern investigators of color vision that the retinal processes which transform the physical energy of the color stimulus into nervous energy is essentially chemical in its nature; and one can not assume that a certain amount of physical energy arouses an equal amount of chemical energy in the retina, or that equal amounts of physical energy arouse equal amounts of chemical energy. In answer to this, the writers would point out that these chemical substances are a part of the retina and their respective iner-

(2) Comparisons of results on many other points with such disparate stimuli seem equally inadequate: the relative time required for the different color sensations to attain their maximum of intensity, or retinal inertia; the relative rate of fatigue to the different colors; after-image and contrast sensitivity, etc.³ In fact there is not a quantitative problem

tias constitute one set of factors that determines the sensitivity of the retina to the different colored lights. It is not necessary to assume, therefore, that a given amount of physical energy arouses an equal amount of chemical energy, etc., in order to make our determinations of the comparative sensitivity of the retina to the different colors in terms of physical units. That would be necessary only if we were trying to separate out the nerve filaments, and to measure or compare their sensitivity to the different colors in terms of physical units. But even in chemical theories when speaking of the comparative sensitivity of the retina to the different colors, we do not mean the comparative sensitivity of the nerve filaments alone. We include the reaction of the chemical substances as well. Our contention, then, is that if the determination of the comparative sensitivity of the retina to the different colors is a proper problem, the determination should be made in terms of quantities that can be compared. This can be done either *a*, by using lights equalized in energy and determining by means of a sectored disc the relative amounts of these lights that are required to arouse sensation; or *b*, by using lights representing different amounts of energy and measuring directly in terms of radiometric units the amounts required to arouse sensation. We scarcely need point out that in speaking of the comparative sensitivity of the retina to the different colors we are not raising a new problem, but are merely recognizing a very old one.

The second criticism is in substance that a quantitative comparison of the effect of the different wave-lengths on the retina is improper because the different wave-lengths constitute stimuli too different in kind to permit of such comparison. This criticism we leave open, because we do not wish to discuss in this paper the propriety of the problem of comparing sensitivities.

³ It is conceivable that two points of view may be held with regard to what is meant by after-image and contrast sensitivity. (1) After-image and contrast sensitivity may express a relation between the amount of light required to arouse after-image and contrast sensations and the unit of light used. (2) It may express a relation between the amount of light required to arouse the after-image and contrast sensations and the amount required to arouse positive sensation. If the former view should be held it will be convenient to start with stimuli equalized in energy, and to determine the relative amounts of light required to arouse the after-image or contrast sensation by means of a sectored disc. If the second view should be held, the energy of the lights used may first be rendered proportional to the sensitivity of the eye to the colors in question; and the liminal values may then be determined by means of the sectored disc. In each case the relative sensitivity may be expressed by the inverse ratio of the open to the closed sectors.

Similarly two views may be held with regard to the determination of the comparative rates of fatigue, and of the development-time of sensation. (1) Lights equalized in energy may be used. (2) The energy

dealing with the comparative functioning of the retina to the different colors in which there does not seem to be a need for the regulation and estimation of the stimulus in terms of a common unit of measurement. It is the purpose of the writer's to extend the work as fast as possible into these related fields.

(3) We wish to make a careful study of the sensitivity of the peripheral retina, quantitative⁴ and qualitative, in a large

of the lights may be made proportional to the sensitivity of the eye to the different colors.

The need in both the above cases is equally great for a method of regulating and determining the amounts of light to be used in terms of a common unit of measurement.

⁴The following are two of the points we wish to take up: (1) A determination will be made of the ratio of sensitivity of peripheral to central retina from point to point for a single color in several meridians. This will show at what rate the retina falls off in sensitivity in a single meridian, and how uniform this decrease is in the different meridians. We have found in a preliminary study that this knowledge is greatly needed in explaining certain phenomena of the peripheral retina. Furthermore, when this determination is made for each of the colors with which we wish to work, the ratios of sensitivity for these colors at all the points can be calculated and a definite answer can be given to the question whether or not uniformity of ratio obtains throughout the retina. This question has been given considerable importance in the discussion of color theories. (2) The limits of sensitivity will be investigated. In general two problems are involved here. (a) The limits may be considered in relation to the comparative sensitivity of the retina to the different colors. (b) They may be considered in relation to existing color theories. In the first of these problems the limits should be obtained with stimuli equalized in energy. So obtained the results will constitute merely another expression of the comparative sensitivity of the retina to the different colors. The second problem is more complicated and will later be made the subject of a separate paper. A word indicating its relation to our present plan of work may, however, not be out of place here. It may be logically assumed, for example, that the Hering theory demands that wherever the blue-sensing substance is found, the yellow-sensing substance must also be found. We have no means of knowing where these substances are except by the sensations aroused. Speaking in terms of the theory, then, we have a right to assume that wherever the blue sensation can be aroused the yellow sensation should be able to be aroused also, provided a sufficiently intensive stimulus be used. If, therefore, in passing towards the periphery of the retina, a point be found where blue can be aroused and yellow can not, the evidence will be strongly in favor of the conclusion that no yellow substance is present, unless it can be shown that elsewhere in the retina so much greater energy of yellow light than of blue is required to arouse sensation that the amount needed for this far peripheral point is greater than can be obtained. To establish this point the comparative sensitivity to these colors would have to be obtained at various points in the retina. This would involve the determination of a ratio based upon the amounts of blue and yellow light required to arouse sensation. Two methods of measurement may be used. (a) The amounts needed may be measured

number of meridians. In general too much uniformity has been assumed with regard to the sensitivity of the peripheral retina. Generalizations of great importance to color theory have frequently been based upon the results of work in which careful investigation was made in only one or two meridians. The conception of stable colors, and its application in support of the Hering *Urfarben* may be taken as a fair example of a sweeping conclusion which is based upon work too limited in its range. With a careful standardization of factors, an investigation in any considerable number of meridians shows that stable colors do not exist.⁵ Many other points of interest have come out in our more detailed study of the peripheral retina. For example, we find in the periphery of the normal retina small areas which are exact replicas of the Schumann case of color-blindness.

(4) We wish to conduct our investigation in full daylight instead of in the dark room. This is to eliminate the influence of the field surrounding the colored stimulus and of the pre-exposure. When the surrounding field is black, white is induced by contrast across the stimulus color. Since the colors all differ in brightness,⁶ the induction takes place in different amounts for the different colors. This white, in proportion to its amount, reduces the action of the colors on the retina. Further, a given amount of white affects to

directly by means of a thermopile of the type we use, or other sensitive radiometer. In a determination of limens the number of readings required would render this method tedious. (b) The energy of the two lights may be made equal by means of a thermopile and the final amounts required to arouse sensation may be secured by means of a sector disc. From the ratio of open to closed sectors the amount the light is cut down in each case may be calculated and the ratios of energy may be determined from these amounts.

⁵The following points are offered in support of the above statement. (1) A red and green cannot be obtained which in every meridian of the peripheral retina will pass into gray without an intermediate change into yellow or blue. (2) The amount of blue that has to be added to a mixture of red and green to produce gray varies from point to point in a given meridian even where the extramacular region alone is considered. Further, a series of determinations made for a given meridian will not hold for the remaining meridians. (3) A red, green, and yellow can not be obtained which will not change in color-tone in passing from the center to the periphery of the retina in a single meridian.

Blue alone of the four principal colors is stable in tone for all parts of the retina.

⁶In a later paper one of the writers (Rand) will show that it is of no advantage to equate in brightness in determining the limits of color sensitivity, and that harm results in so many ways from the attempt to equate that it is doubtful whether it should be done even in determining the limens of color in the more sensitive parts of the retina.

different degrees the action of the different colors on the retina. To eliminate this twofold unequal action, the surrounding field should be made in each case of the brightness of the color to be used. This can be done by working in a light room of constant intensity of illumination and making the surrounding field of a gray paper of the brightness of the stimulus color. In order to accomplish this, and at the same time be able to work upon any meridian of the retina we choose, we have constructed a special piece of apparatus which we call a rotary campimeter. The influence of pre-exposure is even more important than of surrounding field. If the pre-exposure is to black, white is added as after-image to the stimulus color. The effect of a black pre-exposure upon the stimulus color is greater than the effect of a surrounding field of black, because more white is added as after-image of pre-exposure than is induced by contrast from the surrounding field. This effect also can be eliminated only by working in a light room of constant intensity of illumination and by choosing as pre-exposure a gray of the brightness of the color to be used.

We began a quantitative study of the factors that influence the sensitivity of the retina to color three years ago. With the control of factors we had at that time, we could not, for example, duplicate by several degrees at any two consecutive determinations the limits of the zone of sensitivity to any color. The result of our study has been that we are now able with a given light-source to duplicate, within a degree, the results obtained at a previous sitting. We can also duplicate, almost as closely, the threshold values or the amounts of light required to arouse color sensation in the more sensitive parts of the retina. Details of this work will not be given here. They will appear in a series of papers to be published in the course of the present year.

Having completed our work of standardizing the factors extraneous to the source of light, we are trying now to secure a better control of the source. Standardization, so far, can be considered successful only with regard to the quality of the light. No adequate work has been done upon the standardization of the quantity of light. We believe this can be accomplished only by means of energy determinations. We expect to do our radiometric work by means of a surface thermopile (Coblentz model), and a DuBois-Rubens *Panzer-galvanometer*, unless future results show that some other combination of radiometer and galvanometer is more satisfactory.

BOOK REVIEWS

Creative Evolution. By HENRI BERGSON. Translated by A. Mitchell. New York, Holt & Co., 1911. xv+407 p.

In view of the numerous reviews and other discussions of Bergson's *Creative Evolution*, the appearance of this translation is hardly a sufficient justification for another extended and detailed exposition of the work. All students of philosophy, however, will be glad to see that Bergson is being made more accessible to the English-speaking public, particularly when the work of translating is done so successfully as in the present instance. That the translator has brought to his task a proper sense of the obligation which he had assumed is evident from the fact that he has combined so well the demands of accuracy with Bergson's well-known felicity of style. The service to philosophy is all the greater from the timeliness of the work.

Aside from its intrinsic merit, Bergson's *Creative Evolution* is of peculiar significance at the present time because it makes prominent an element in the pragmatic movement which requires just such emphasis as Bergson gives to it. The pragmatic attack on rival theories that has been going on of recent years has undoubtedly been lacking in some of the aspects of organized warfare. To a considerable extent the assaults have been determined by the tastes and predilections of the individual leaders. Sometimes it is the question of truth that is put into the foreground; at other times it is the fact that experiencing or knowing works a change in its object; or again it is the dictum that man is the measure of things. These different topics are of course far from being unrelated. But the peculiar intimacy of their union, and at the same time their compatibility with the belief in an external world along the general lines of naïve realism has not been brought out as fully as the case permitted; and hence an air of subjectivism and paradox has hung about the pragmatic position. It would scarcely be correct to say that *Creative Evolution* is a conscious attempt to remedy this defect. But at all events, the emphasis of Bergson's discussion is preponderantly on the 'objective' side; and moreover his treatment of duration may serve as a convenient means wherewith to correlate and unify the pragmatic point of view.

That duration is a real fact is in itself scarcely a novel doctrine. In Bergson's hands, however, this fact becomes alive with new vigor and with added significance. That the past is prolonged into the present and abides there, actual and acting, not only furnishes us with the clue to the errors of other systems, but it enables us to pool our mysteries and our epistemological perplexities in the one inclusive fact that Becoming is more fundamental than Being. As a rule, the insistence that duration is real has not prevented thinkers from taking away with the left hand what was previously bestowed with the right. A consistent treatment of duration from this standpoint necessitates a radical reconstruction of our theories concerning the relation of consciousness and object, a reconstruction that has never been rigorously carried out in the past. If we hold, for example, that the character of duration is such as to compel the belief that the past is in some sense

projected into the present, our recollections of the past are evidently put on a wholly different footing. According to Bergson, "the very basis of our conscious existence is memory, that is to say, the prolongation of the past into the present, or, in a word, duration acting and irreversible" (p. 17). In order to recall the past, then, it is neither necessary nor possible to copy or apprehend a pre-existent reality, for theories of this sort ascribe to the past, by implication at least, a finished character which abolishes what is essential in duration. Nor have we need of resort to a transcendental unity which holds together in eternal completeness the constituents of the temporal process, since such a unity likewise nullifies time. As James says, "*Reality falls* in passing into conceptual analysis; it *mounts* in living its own undivided life—it buds and bourgeons, changes and creates. Once adopt the movement of this life in any given instance and you know what Bergson calls the *devenir réel* by which the thing evolves and grows." And he adds that "philosophy should seek this kind of living understanding of the movement of reality, not follow science in vainly patching together the fragments of its dead results." (*Pluralistic Universe*, p. 264.)

This standpoint, furthermore, provides the answer to the question how it is possible to know a pre-experiential reality. Our human experiences may be viewed as the culminating points in which are merged the pre-existent enduring processes of the real that lead up to them. Within those experiences we find that onward rush, that all-penetrating change, without which time is naught. Because time is of this character, we can take our stand within our experiences and make affirmations regarding the events which occurred prior to all experience. Our experience is immersed, so to speak, in the flux of things: it is not a function that dwells apart in order to take photographic note of mundane events. Our experiences testify to a past and a future from which they can be separated only by abstraction. The apparent difficulty as to how our knowing can produce a change in things without thereby falsifying its data is, therefore, no genuine difficulty at all. It is simply a special phase of the question as to how anything can change without losing its identity as a result. Before this question our logic is helpless, since it is obliged to abstract and to fixate its material before it can proceed. But the real is constantly solving the puzzle which our logic declares to be insoluble, since it maintains the supremacy of Becoming over Being and enthrones change and flow at the heart of things. If Becoming is in any true sense our final category, it is clear that we must look to the end in order to understand the beginning. The necessity of interpreting things in terms of our human experience is not a limitation or a concession to our finitude and impotence, but is a condition imposed by the real itself. To quote James again: "Undeniably something comes by the counting [of the stars in the 'dipper' constellation] that was not there before. And yet that something was *always true*. In one sense you create it, and in another sense you *find* it. You have to treat your count as true beforehand, the moment you come to treat the matter at all." (*The Meaning of Truth*, p. 94.)

Bergson's view, moreover, forces him to the conclusion that knowledge is of a 'practical' character. Since the real is in incessant change, the only way in which we can know it is to have the living, changing experience. Logical analysis inevitably changes its nature. We murder to dissect. In order to control our experiences we endow certain features of them with a permanence which is not theirs by inherent

right. The truth of our conceptual thinking is therefore necessarily relative to the end which we have in view at the moment. "If the intellect were meant for pure theorizing, it would take its place within movement, for movement is reality itself, and immobility is always only apparent or relative. But the intellect is meant for something different. Unless it does violence to itself, it takes the opposite course; it always starts from immobility, as if this were the ultimate reality; when it tries to form an idea of movement, it does so by constructing movement out of immobilities put together" (p. 155).

This contrast, however, between movement and immobility may lend itself to misinterpretation. Since thought is unable to grasp Becoming or duration, we seem to have here a peculiar opposition between thought and immediate experience. Yet the assertion that "movement is reality itself" presumably is not to be taken in the sense that movement is always an experienced fact wherever there is any experience at all, but that when we reflect upon our experiences we are obliged to assert the "reality" of the movement, even though our attention may not have been directed to the movement at the time. Movement is real in that it is "true" for all experiences. Until there is occasion for reflection, neither Becoming nor Being need be experienced as such. In other words, the concept of Becoming is as much a tool as is any other concept. Becoming or duration is more fundamental than static being, in that it is the concept which must be employed when we reflect upon the procedure of the sciences and of every day thinking and attempt to reconstruct our data so as to harmonize and unify our knowledge.

It should be added, in conclusion, that in these brief comments the bearing of the principles laid down in *Creative Evolution* upon current questions is stated rather more directly than is done by Bergson himself. Moreover, a great deal that is interesting and significant in his exposition is necessarily omitted from consideration here. There can be no doubt that Dr. Mitchell's excellent translation will secure for the author a circle of readers more nearly commensurate with his importance for present-day thought.

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The Baganda: An Account of their Native Customs and Beliefs. By the Rev. J. Roscoe. London, Macmillan & Co.; New York, The Macmillan Co., 1911. pp. xix., 547. Price \$5 net.

The Bantu kingdom of Buganda, now one of the five provinces of the Uganda Protectorate, lies on the northwest shore of Lake Victoria Nyanza. It fills a troubled chapter in the colonial history of the last quarter of the nineteenth century; and the name of its last great king, Mutesa, is familiar—in the puzzling form M'tesa—to every one who has dipped into the story of African exploration. Mutesa reigned from 1857 to 1884; it was he who welcomed the Zanzibar Arabs and from their example reclothed and rearmed his subjects; it was he, too, who received Speke in 1862 and Stanley in 1875, and who through Stanley appealed to the people of England for missionaries. Mr. Roscoe, himself a missionary sent out by the C. M. S., tells us in his preface that he spent twenty-five years in the country. He must, then, in all probability, have arrived in Buganda before Mutesa's death and the murder of Bishop Hannington; he must have witnessed the coming of Lugard with Sudanese and sleeping-sickness in 1891; and he saw the final reconstruction of government and administration effected by Sir Harry Johnston in 1899 and the following years. Of all these things the

book tells us nothing; recent history is summed up in a few bare paragraphs on pp. 229 f. Mr. Roscoe's interest lies elsewhere. He is a friend and pupil of Professor J. G. Frazer, and he has utilised his leisure, during the last eighteen years of his missionary life, in gathering notes upon the social and religious life of the Baganda before the kingdom was thrown open to foreigners. His information has been gathered from the older men, who neither knew English nor had come into contact with Europeans; and he has received very material aid from the regent and prime minister of the province, Sir A. Kagwa, who secured interviews with priests, medicine-men, temple mediums and chiefs, and who prepared and annotated plans of the old Capital and of the Royal Enclosure. Further assistance has been rendered by Professors Frazer and Myers, and by Drs. Haddon and Rivers.

It is plain, then, that Mr. Roscoe had an excellent opportunity and that he has made the most of it. The Buganda of to-day is a very different country from the Buganda of 1870. Even in Mr. Roscoe's earlier years, "the old men who knew most about the former religious customs were not numerous; war and famine had killed most of them." Here, as in many other places, anthropology seems to have had but a single chance: let the man be wanting, and a certain store of knowledge is lost forever. Mr. Roscoe makes, on principle, no reference to published works, whether by himself (readers of the *Golden Bough* will be familiar with his papers in the *Journal of the Anthropological Institute*) or by other travelers; and though there are many books that treat of Uganda, from Speke's *Source of the Nile* to Tucker's *Eighteen Years*, it is safe to say that the present volume is and will remain the authoritative source-book for students of anthropology.

After a general survey of the country, and the life and customs of its inhabitants, come chapters dealing with the fate and fortunes of the individual: birth, infancy and puberty; marriage; sickness, death and burial. From these topics we pass to relationship, and to the clans and their totems. Then follow single chapters on the king, government, religion, and warfare; and then a group of chapters on industries, domestic animals, agriculture and food, hunting, markets and currency, and wells. A final chapter gives specimens of folk-lore tales and proverbs, and the book ends with anthropometrical tables, the two plans mentioned above, and a good index. Mr. Roscoe writes in a simple, straightforward style, and records his facts without straying into theory. He speaks naturally, in just the right scientific tone, of matters that are all too human. His accounts of such things as house building, fence making, canoe building, pottery, are very clear, and can easily be followed in the text alone; the photographs are literally illustrations, and not working diagrams. A good many of his observations, especially in contexts that interest the psychologist, have already been embodied in the *Golden Bough*; and the chapters thus lose something of their freshness; they do not, I need hardly say, thereby lose in value.

The photographic illustrations—most of them from plates made in the country; a few from museum specimens—are adequate. Figs. 20 and 24 represent the same tomb or temple under different names; but the text clears up the difficulty. It would, I think, have been worth while, particularly since the anthropometric tables are included, to insert a series of photographs of individual men and women, if only to differentiate the types (Bahima, Baganda, Basese) which the author expressly mentions; and it could have done no harm to add a few references to statements like that of p. 187, that the kings are in all probability of Galla descent.

E. B. T.

The Development of certain Instincts and Habits in the Chicks. By FREDERICK S. BREED. Behavior Monographs, I, 1911. pp. 78.

This study—the first in the series of Behavior Monographs—records the results of experimental observations on chicks from the moment of their birth, covering a period of twenty-five days. The observations were made at the Harvard psychological laboratory, and pertain to the development of the drinking and pecking reactions, especially the latter. Incidentally the author studied the development of certain habits in response to visual stimuli, their interrelation, and the conditions which influence their persistence.

For these observations an incubator and a brooder were used, so arranged that a complete life history could be obtained of each bird. The widespread belief that chicks peck their way out of the shell is discredited by the author, who argues from the position of the chick in the shell that this could not be the case. Pecking is scarcely possible, since the chicken's head is folded down over the breast. A lifting movement of the head to free it and the neck from their folded position is probably responsible for the breaking of the shell, but the author brings no positive proofs that this is so. On the contrary, he states that chicks only a few hours out of the shell may be seen executing "into the air" what might be called the pecking reaction, followed by a sudden clapping together of the mandibles. This matter remains to be settled by the use of a technique recently developed elsewhere which permits the keeping of developing chicks *in situ*, under continuous observation.

Concerning their drinking reaction it is commonly held that chickens swallow water instinctively, but that they must learn to drink by imitation, if not by accident. This does not square with the author's observations, for he found that chicks respond with the drinking reaction to various olfactory impressions such as, surface of white paper, edge of white glazed kymograph paper, edge of glass dish, and black leather watch fob; they do so without any previous experience and under conditions which preclude the possibility of learning by imitation or by accident.

Whether the visual stimulus caused by still water is sufficient to bring about the drinking reaction, the author is not prepared to state definitely. According to the view now prevalent, such a stimulus is not enough. It would be interesting in this connection to know whether the sight of still water evokes the drinking reaction in chicks deprived of water for a long time after hatching. This matter, too, is left unsolved by the present investigator.

We turn now to the main portion of the author's work, his investigation of the pecking reaction; it consists of three distinct movements,—striking, seizing, and swallowing. The accuracy of this reaction, which has always occupied the center of attention among experimentalists, depends upon the degree of accuracy of each of these movements. In other words, the reaction as a whole may be retarded or it may fail at any one of these three stages. The widely quoted observations of Spalding, who blindfolded his chicks with hoods as soon as they left the shell, showed a great accuracy in pecking, the chicks never missing by more than a hair's breadth even the most minute particles at which they aim; what is more, they do not attempt to seize anything beyond their reach. These observations produced a profound impression and have been quoted abundantly, among others by Romanes, in order to illustrate the perfect adaptation of means to end through the operation of instinct. Preyer was among the earliest investigators to doubt this

view, although even he believed that the accuracy of the pecking reaction at the very beginning is marvelously perfect in chicks. By studying the reaction in its three component acts,—striking, seizing, swallowing,—the author found that Morgan and Thorndike, among the modern investigators, are correct when they assert that the pecking reaction is far from being perfect at birth. But he also found no reason to share Thorndike's doubt that this reaction improves after birth. Breed is convinced that it does; but whether the improvement is "dependent upon practice or is the natural functional correlate of structural maturation independent of practice" he is unable to state. In the absence of data which would justify either position to the total exclusion of the other, Breed is inclined to accept a view which represents the middle road. Improvement, while clearly influenced by practice, does not depend altogether upon it. Both maturation and use improve function. The improvement would proceed without practice but is hastened by it.

The author's most important finding about the pecking reaction, requiring however additional documentation before it may be accepted as fully established, is that the manifestation of the pecking instinct was retarded by disuse; also, that the retardation was quickly overcome by use. A corroboration of these data would justify, in a great measure, the author's position that both maturation and use enter as factors in improvement. The observations showed that, in the ordinary course, the accuracy of pecking improved most rapidly at first, reaching, by the third day, an efficiency represented by 29.29 upon a scale of fifty. At the beginning of the eleventh day the efficiency reached a little over 40. From that time on the rate of improvement was exceedingly slow so that, at the end of the period of observation, on the twenty-fifth day, it registered a maximum of 42.57.

The greatest number of errors in the pecking reaction were observed during the seizing act. This condition persisted throughout the period of observation. Swallowing led to fewer errors, but the striking act was the most accurate. From this it may readily be seen how one, limiting one's observations to the striking act or depending chiefly upon it for an appraisal of the pecking instinct, may be led to assume a degree of accuracy which does not hold for the reaction as a whole. Doubtless certain of the results of the earlier investigators have been influenced by some such limitation as this; hence the discrepancy between them and the results of the present study.

The author believes that he has discerned in chicks some selective response to objects of different size, also to color, apart of intensity; but form tests were uniformly negative. His findings as to the effect of social influence are not definite enough.

There was no evidence to show conclusively that an established black-blue habit influenced in any degree the rate of acquiring the small-large habit. The chicks were trained in the black-blue habit by the use of the electric shock, in the usual manner. It was found that frequently the reactions were determined not by the free color, but by the one with which the electric shock was associated. Such actively negative reactions show that, psychologically, negation is not affirmation.

Five of the nine chicks thus trained showed perfect tests in black-blue after a thirty days' interval. The "index of modifiability" for the whole group of nine was 72.2. Nothing was learned about the time of appearance of the various reactions, such as flapping the wings, preening, chirping, scratching, twittering, or wiping the bill.

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BOOK NOTES

The mind of primitive man. By FRANZ BOAS. New York, The Macmillan Co., 1911. 294 p.

In these lectures, the author has brought together in available form for the general reader the results of his many years of special researches covering almost the entire field of anthropology, physical, linguistic, social, psychological. It is impossible within the limits of our space to do justice here to this admirable and comprehensive treatise. In the first chapter, he characterizes race prejudice which he shows has always been with us and is one of the great sources of error in this field. Then comes the influence of environment upon human types, then that of heredity, the mental traits of primitive and civilized man, race and language, the universality of cultural traits, the evolutionary viewpoint, some traits of primitive culture—these are the chief themes with a secondary and an appended chapter on race problems in the United States. One of the central thoughts running through the volume is that the intelligence and mental powers of primitive races is by no means so inferior as is generally thought, if indeed it is at all inferior to that of modern man. To have given valid and sufficient grounds for this conviction is to do great public service. But we believe that no impartial reader of the book, even though he may think that the author's view is slightly too extreme can fail to gain from it a more sane and wholesome estimate of what primitive man really is and stands for.

Examination of Professor William James' psychology. By IKBAL KICHEN SHARGHA. Allabad, Ram Narain Lal, 1909. 118 p.

This is a drastic criticism of Professor James' psychology which tries to show that most of his errors and much of his confusion is due to his inability to make up his mind as to the relation between brain and consciousness. Many very diverse points of view are cited by this author who concludes that "although all these shifting views are adopted and abandoned by turns, we find that Professor James, consciously or unconsciously, leans to the materialistic theory that the body is after all the real thing and that consciousness is a supernumerary phenomenon, that neural changes are invariably the cause of mental states and are in no way affected by them." To most psychologists the knowledge of the objective world based on sensations usually regarded as subjective affords a difficult problem, but James cuts the Gordian knot by maintaining that sensations are from the first in external space. He has certainly worked his hypothesis "for all it is worth" and "allowed psychology full headway on the materialistic tack."

Zur Psychologie und Ethik. Von WILHELM M. WUNDT. Hrsg. von Jul. A. Wentzel. Leipzig, P. Reclam, 1911. 206 p.

This little work attempts to present some of the most important points in Wundt's philosophy in quotations. The topics treated are: the origin of language and Märchen, the problem of experimental psychology, ethical norms, right vocation, etc. This, together with Wundt's primer, a little introduction of Rudolf Eisler and the book of Edmund

König constitute four very good introductions to Wundt's system now available to students of his works.

Die differentielle Psychologie in ihren methodischen Grundlagen. Von WILLIAM STERN. Leipzig, J. A. Barth, 1911. 503 p.

The writer attempts to bring together and make a rather exhaustive grammar of all the chief methods by which individual differences, especially among children, are studied. He takes up introspection, the non-experimental, experimental methods, the questionnaire, how to approach variations and correlations, the various methods of investigating individuality in order to make a true psychogram. The work is of extreme value and timeliness and its value is augmented by nearly one hundred pages of carefully selected bibliography. It is hoped that we can present our readers with a fuller review of this work a little later.

Experimental pedagogy and the psychology of the child. By ED. CLAPARÈDE. Translated from the 4th edition of "Psychologie de l'enfant et pédagogie expérimentale" by Mary Louch and Henry Holman. New York, Longmans, Green & Co., 1911. 332 p.

The translators have rendered us a real service in making this book accessible to English readers. The author desires to introduce the educator to psychological science and particularly to the psychology of the child. He finds the subject so diversified and the sources so scattered that there is great need of a guide and this need he attempts to supply. He groups his material under four chief heads, the problem, methods, mental development, and intellectual fatigue. This work admirably illustrates how very rapidly psychology is becoming a practical science.

The souls of black folk; essays and sketches. By W. E. BURGHARDT DU BOIS. Eighth edition. Chicago, A. C. McClurg & Co., 1909. 265 p.

This book contains fourteen chapters of perhaps the most scholarly of all the negroes in this country. He writes on the negro's spiritual strivings, the dawn of freedom, meaning of progress, the training of the black men, the black belt, the quest of the golden fleece, the sons of master and man, faith of the fathers, the passing of the first-born, Alexander Crummell, the coming of John, sorrow songs, Booker Washington, the wings of Atalanta. It is a pathetic book. The author's position is well-known. It is best defined by his relations to Booker Washington, whom he criticizes for holding that the South is justified in its present attitude toward the negro because of the negro's degradation, that his present failure to rise more quickly is due to his wrong education, and that his future depends primarily on his own efforts. Each of these he designates as a dangerous half-truth. This is indeed a remarkable book, full of pathos and insight, a book that everyone interested in this great national problem should read and ponder. It is the ablest book ever written in defence of the negro's position for it represents the standpoint of the progressive members of the colored race, who feel profoundly that the color line is bitter and cruel injustice.

Report of the control of the aborigines in Formosa. By BUREAU OF ABORIGINAL AFFAIRS. Formosa, Taikohu, 1911. 45 p.

This work seems to have been done under the direction of Rimpei Otsu, Superintendent of the Bureau of Aboriginal Affairs in the Gov-

ernment of Formosa. It does not pretend to give a full account of the control of the aborigines but in condensed form to tell what was done in controlling them to November, 1909. The work is very copiously illustrated and is of great interest throughout. It seems to us a model of its kind. Here, unlike our own dealings with the Indians, ethnological study and administrative efficiency have gone hand in hand and whatever is learned by anthropologists is immediately put to practice and there are no such watertight compartments as exist in Washington between the Ethnological and Indian Bureaus.

An unknown people in an unknown land. By W. BARBROOKE GRUBB. Edited by H. T. Morrey Jones. London, Seeley & Co., Ltd., 1911. 330 p.

This book is devoted to a discussion of the Indians of the Paraguayan Chacos and has six illustrations and a map.

The golden bough: a study in magic and religion. Part III, the dying god. By JAMES G. FRAZER. London, Macmillan & Co., 1911. 305 p. Third edition.

This third part takes up the question why had the king of the wood at Nemi regularly to perish by the hand of his successor. In the first part, the author told us why the king of the woods personated Jupiter, the deity of the oak, of thunder and of the sky. His answer to the question to which this volume is devoted is that the motive for slaying the man god is fear lest with the feeble body in sickness and old age his spirit should decay and thus the course of nature be imperiled, so this custom, wherever it prevailed, was a pathetic attempt to disengage the immortal spirit from its mortal envelope in order to arrest the decay of nature by retrenching the first symptoms of decay to make the great wheels of the world stand still and to keep it fresh, young and fair. Thus men have groped to find "the golden key that opens the palace of eternity." This at any rate is a happy dream. In the various chapters, the author discusses the mortality of gods, the killing of divine kings, slaying of kings in legends, the supply of kings, temporary kings, their sacrifice, succession to the soul and killing of the tree spirit, with a note on Chinese indifference to death.

The fairy-faith in Celtic countries. By W. Y. EVANS WENTZ. New York, Henry Frowde, 1911. 524 p.

The main topics in this charming book are: the taking of evidence, anthropological examination of it, the recorded fairy faith, the people of the Goddess Diana, Brythonic divinities and fairy tales, Celtic other-world, the doctrine of the rebirth. Then comes the cult of gods, spirits, fairies and the dead, with the testimony of archaeology, paganism and Christianity, and finally, modern science and the fairy faith. The Celtic doctrine of rebirth and the other world is scientifically explained.

The evolution of animal intelligence. By S. J. HOLMES. New York, Henry Holt & Co., 1911. 296 p.

The author begins with reflex action and then treats tropisms, the behavior of protozoa, instinct, its evolution, modifications of behavior, pleasure, pain and the beginnings of intelligence, primitive types of intelligence in crustacea and mollusks, insects, lower vertebrates, mam-

mals, with a final chapter on the mental life of apes and monkeys. It is mainly a compilation, but is, as the writer intimates, somewhat fragmentary.

Scientific features of modern medicine. By FREDERIC S. LEE. New York, The Columbia University Press, 1911. 183 p. (Columbia University Lectures.)

The chief chapters are: the nature of disease and diagnosis, methods of treating, bacteria, prevention of infection, the problem of cancer, modern surgery, the rôle of experiment, the public and the medical profession.

Mental fatigue. By MAX OFFNER. Baltimore, Warwick & York, Inc., 1911. 133 p. (Translated from the German by Guy Montrose Whipple. Educational Psychology Monographs.)

This work collates, systematizes and appraises the mass of scattered and to most readers inaccessible material that bears upon this vital school-room problem. The author's bibliography was mainly German but the translator has added some of the best references available in literature. The work treats of the symptoms, measurements, methods, physiological and psychological, results, laws of fatigue, with certain general conclusions.

Biyonde cifrun (beyond zero). By GEORGE D. BUCHANAN. Boston, Buchanan & Co., 1911. 64 p.

The new is always growing within and without the world. The presence of matter does not exclude all else. Man has more than five senses. The chapters are how planets grow and wane; what we are and what death is; importance of life this side of the grave; a new doctrine. The idea of the book is to show that there are things beyond the zero of sense.

Laughter; an essay on the meaning of the comic. By HENRI BERGSON. Authorized translation by Cloudesley Brereton. London, Macmillan & Co., 1911. 200 p.

This work is based upon a revision by the author and the present translation is the only authorized one. It originally appeared in the *Revue de Paris*, hence it is simple, direct, formal. In France the book has reached its seventh edition and has been translated into many languages. Its success is due partly to the novelty of its explanation of the comic and partly to the fact that the author incidentally discusses so many other important questions.

Die Anfänge der Musik. Von CARL STUMPF. Leipzig, J. A. Barth, 1911. 209 p.

The author here greatly enlarges the Berlin lecture which had formerly been printed, which sets forth the fruits of ethnological studies on music in which, for more than one decennium, he has been occupied. This book is made up of two parts, the first on the origin and primitive forms of music. Here the writer treats new theories, origin of song, primitive instruments and their influence, polyphony, rhythm, song with language, developmental directions. And the second part is devoted to the songs of primitive people and the descriptions of primitive instruments. Every chapter of the book is illustrated with specimens of music and in the end there are cuts of barbaric instruments.

Lehrbuch der philosophischen Propädeutik. Von RUDOLF LEHMANN. Berlin, Reuther & Reichard, 1911. 192 p.

This little introduction starts with an epitome of logic, including its conception and definition, judgment and idea, method and epistemology. Then comes a section on the theory of knowledge, then an outline of psychology, with special stress on the origin and lapse of concepts, the life of feeling and will, then the basal ideas of ethics, and finally an introduction to aesthetics.

Twenty-seventh annual report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1905-06. Washington, Govt. Printing Office, 1911. 672 p.

This volume is devoted chiefly to a very luminous study of the Omaha Tribe of Indians by Alice Fletcher and Frances La Flesche. This monograph appears to be, as indeed we should expect from the authors of it, one of the very best in the entire series of the Bureau of Ethnology Reports.

Motive-force and motivation-tracts. By E. BOYD BARRETT, S. J. New York, Longmans, Green & Co., 1911. 225 p.

The chapters are: modern theories of will, object of the present research, motives, motive force and measurement, motivation tracts, evolution of motivation, automatism, hedonism, relativity of values, psychology of character. This is one of its ablest and original investigations in the important new field opened up by the Würzburg school.

The mental man. By GUSTAV GOTTLIEB WENZLAFF. New York, Charles E. Merrill Co., 1909. 272 p.

This little text-book is based largely upon Sanford, Barker, Jastrow, Seton, Tufts and Angell and discusses the physical basis, conscious life, will, habituation, heredity, impulse and instinct, feeling, sensation, fusion and discrimination, perception, unexplained mental phenomena and memory, imagination, conception, thinking, knowledge, suggestion, the self and mental types. A cursory survey impresses us that this is a pretty good elementary introduction along with the little handbook that goes with it.

Weltbegriff und Erkenntnisbegriff. Von VIKTOR KRAFT. Leipzig, Johann Ambrosius Barth, 1912. 232 p.

The focus of this book is idealism. The author first discusses the problem of the world idea and its historical development. He finds typical forms of the idea of the cosmos, viz., dualistic and monistic; under the latter, the views of psychophysical identity, materialism, idealism, positivism. He then takes up the typical ideas of knowledge and shows its relation to the cosmic idea. Then comes the foundation of realism and finally the doctrine the author advocates of transcendental ideality, the relation of objective ideality to the noetic consciousness.

Anleitung beim Studium des Baues der nervösen Zentralorgane im gesunden und kranken Zustande. Von HEINRICH OBERSTEINER. Leipzig, Franz Deuticke, 1912. 764 p. (Fifth enl. rev. ed.)

This book was for a long time a students' favorite and had passed through various editions, but was becoming a little antiquated. All interested in the subject will therefore thank the author that in this edition he has considerably increased his volume, adding new matter to date and also written over many parts of it which were in need thereof.

Psychologie und Pädagogik des Gedächtnisses. Von HANS SCHÖNEBERGER. Leipzig, Otto Nemnich, 1911. 148 p. (Pädagogische Monographien, XII Band.)

The scope of this work can be suggested by the titles of its several chapters. The first resumé the most important results of investigations on the Ebbinghaus lines; the next describes the experiments of Müller and Pilzecker; the third, the investigations and results of a scientific and theoretical nature; and the fourth, those of a chiefly pedagogic and practical nature. The attempt of the book is to give a good outline of the present status of the problem.

Die Seele des Gesunden und Kranken. Von CARL SEHER. Berlin, Martin Warneck, 1910. 159 p.

The writer first treats the relations of body and soul, then thinking, willing, logic, psychiatry and certain diseases, the boundary between theology and medicine and then discusses certain psychic forces, such as the subconscious, hypnotism, symbolism, magnetism, spiritism, Christian science. The latter is treated in a very sensible way.

Studies in immunity. By JULES BORDET and his collaborators. New York, John Wiley & Sons, 1909. 545 p. (Collected and translated by Frederick P. Gay.)

Although for more than fifteen years a protagonist in the modern development of immunity, Bordet has continued an investigator instead of becoming a generalizer. He has been led by the thoroughness of observation and brilliancy of inductive reason and the collection of successive significant facts rather than to developing a theory. The work consists of thirty-one special papers, mostly by Bordet, but a few of which were written by his pupils, including Dr. Gay, the translator. Bordet has himself written a general resumé of the subject of immunity as a final chapter for this work.

Experimental studies in judgment: judgments of the comic. By H. L. HOLLINGWORTH. Reprinted from *The Psychological Review*, March, 1911, Vol. XVIII, pp. 132-156.

Difference-sensibility for rate of discrete impressions. By KNIGHT DUNLAP. Reprinted from *The Psychological Review*, January, 1912, Vol. XIX, No. 1, pp. 32-59.

Palmesthetic difference sensibility for rate. By KNIGHT DUNLAP. Reprinted from *The American Journal of Psychiatry*, November 1, 1911, Vol. XXIX, No. 1, pp. 108-114.

De l'attention. Par EUGENIA RIGNANO. Extrait de *Scientia*, Vol. XI, 6^{ème} Année, 1912, pp. 71-87.

On Freud's psycho-analytic method and its evolution. By JAMES P. PUTNAM. Boston, W. M. Leonard, 1912. 20 p. (Reprinted from *The Boston Medical and Surgical Journal*, Vol. CLXVI, No. 4, pp. 115-122, January 25, 1912.)

Insanity and criminal responsibility: preliminary report of Committee B of the American Institute of Criminal Law and Criminology. Reprinted from the *Journal of the American Institute of Criminal Law and Criminology*, November, 1911. 21 p.

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FURTHER EXPERIMENTS ON THE INHIBITION OF SENSATIONS

By EDMUND JACOBSON

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§ 1. *Introduction.*—Inhibition may be defined as the reduction of any conscious activity while the stimulus is in operation and undergoes no corresponding diminution. The reduction may be either partial or complete, but must not be due to fatigue. This definition is strictly empirical, and is designed to cover all past work in the psychological field. We may add that while the loss may conceivably be of intensity, extent, or any other attribute, each type needs to be experimentally demonstrated.

Examples of inhibition of intensity were reported in a paper of last year (*Psy. Rev.*, Jan., 1911). It was concluded that sensations of certain types, at least, may have a diminished intensity owing to the presence of certain other sensations. We found that this kind of inhibition was dependent upon the attention of the subject: when he was trained to increase his attention to pressure sensations, for example, these were no

longer inhibited by the sound sensations; and when, on the other hand, he increased his attention to the sounds, these diminished the pressure sensations most markedly.

In order to learn whether these results could be extended, I undertook more experiments last year at Cornell University. The observers were Miss Mabel E. Goudge (graduate student), Mr. E. G. Boring (assistant in psychology), Mr. A. S. Edwards (graduate), and Mr. C. A. Ruchmich (present instructor). G and B worked three hours per week and E somewhat less during both terms; R gave this number of hours during the first term.

PART I

The Effect of (Strong) Auditory Sensations on the Intensity of Simultaneous Odors

§ 2. *Procedure.*—The sounds were made with an electrical buzzer placed near the left ear, and were thus of fairly constant character. With an olfactometer the odor stimuli were varied in strength at will. (See Appendix, § 1.) Also we needed to measure the intensities of the odor sensations, and our way of doing this may be explained as follows: We choose two stimuli, S and C, and find the number of times out of eight that C is called fainter than S. Now it is evident that the weaker a sensation is, the more times will it in the long run be called weaker than a certain constant other one with which it is compared. Therefore, if the sensation from stimulus C given with the sound is more often called weaker than when given without the sound we may conclude that the sound has reduced the intensity of the sensation of C.

Accordingly we give our odors in pairs,—S-C and S-C (with sound). Two more pairs arise upon changing the order,—C-S and C (with sound)-S. In Table I are shown the various strengths of the odors used for each observer. For Observer B what we have just called S appears as the figure 11, while C is represented by 3 and again by 18. Thus we plan to find the number of times out of eight that 3 is called fainter than 11, when the former occurs with and also without the sound. Similarly with 18 and 11. We have stated this method of calculation at greater length in the previous paper.

The way of getting the odors was this: The signal 'Ready!' came first, followed soon by 'One!' when the observer placed his nostril over the opening of the tube and inspired; next he removed the nostril and awaited the second signal, then took the second odor and said which was stronger.

TABLE I.

	Observer B		Observer G		Observer E		Observer R	
	First Odor Given	Second Odor Given	First Odor Given	Second Odor Given	First Odor Given	Second Odor Given	First Odor Given	Second Odor Given
A	11	3	7	3	8	3	10	3
B	3	11	3	7	3	8	3	10
C	11	3/n	7	3/n	8	3/n	10	3/n
D	3/n	11	3/n	7	3/n	8	3/n	10
E	11	18	7	11	8	13	10	17
F	18	11	11	7	13	8	17	10
G	11	18/n	7	11/n	8	13/n	10	17/n
H	18/n	11	11/n	7	13/n	8	17/n	10

In Table I are shown the various pairs of odors given to each observer. The figures stand for the strength of the stimuli, expressed in half centimeters of exposure of the odorous cylinder. The capital letters stand for the pairs of stimuli, e.g., the A-pair for Observer B is 11—3. The sign /n indicates the occurrence of the sound.

Experiments in this field of inhibition need to be carried out with great care, and we give in the Appendix a list of precautions which were observed. (See Appendix, § 2.)

§ 3. *Results and Discussion.*—Figures which show the intensities of odors as judged with and without the sound appear in Table II.

TABLE II.

		Observer B		Observer E		Observer G		Observer R	
Series 1-A									
A	C	6 1/2	1 1/2	5 1/2	6 1/2	6	6 1/2	4	5
B	D	2 1/2	2 1/2	5 1/2	5 1/2	6	7	5	1
A+B	C+D	9	4	11	12	12	13 1/2	9	6
E	G	3	1 1/2	3 1/2	3 1/2	3	1 1/2	0	4
F	H	2	2	1	1/2	2	2	0	1
E+F	G+H	5	3 1/2	4 1/2	4	5	3 1/2	0	5
A+B+E+F C+D+G+H		14	7 1/2	15 1/2	16	17	17	9	11
Series 1-B									
A	C	6 1/2	3	7 1/2	7 1/2	6	8	5	7
B	D	5 1/2	3 1/2	6	6	7	8	1	3
A+B	C+D	12	6 1/2	13 1/2	13 1/2	13	16	6	10
E	G	2	5 1/2	3	1 1/2	2	2 1/2	4	0
F	H	1	3	1 1/2	1 1/2	1 1/2	2 1/2	1	1
E+F	G+H	3	8 1/2	4 1/2	2 1/2	3 1/2	5	5	1
A+B+E+F C+D+G+H		15	15	18	15 1/2	16 1/2	21	11	11

TABLE II—Continued

Series 1-C

A	C	7½	6½	5	4
B	D	6½	6	8	4
A+B	C+D	14	12½	13	8
E	G	4	3½	5	4
F	H	0	1½	1	1
E+F	G+H	4	5	6	5
A+B+E+F C+D+G+H		18	17½	19	13

Series 1-D

A	C	4½	4	6½	7½	7½	7	6	3
B	D	6½	4	7	3½	5½	6	4	4
A+B	C+D	11	8	13½	11	13	13	10	7
E	G	4	2½	4½	4½	3½	3	3	0
F	H	2½	1	½	2	1½	0	7	0
E+F	G+H	6½	3½	5	6½	5	3	10	0
A+B+E+F C+D+G+H		17½	11½	18½	17½	18	16	20	7
Total sum		46½	34	52	40	69½	71½	59	42

Figures opposite single letters in Roman type (A or B or E or F) in each case represent the number of times out of eight that the odor from a certain stimulus was judged fainter than a certain other (see Table I); while in the space to the right of each such figure in Roman is a corresponding figure in italic which represents the number of times that the odor from the same stimulus was judged fainter than that from the same other stimulus when the sound was made simultaneously with the former. For any observer it will be seen that the italic figures are not generally nor in their sums (markedly) larger than the Roman; therefore the figures fail to demonstrate that the sound generally inhibited the odor.

The above figures, as explained in the note under the table, do not permit us to conclude that the sound sensation generally inhibited the odor. In fact, the odor with the sound seems rather to have had an augmented intensity.

The results were unexpected for two reasons: first, because they were unlike those attained in the previous experiments under similar circumstances, where pressures and sounds had been judged;¹ and secondly, because the observers at the beginning of the series had themselves occasionally mentioned the odor being blotted out or cut off by the sound.

Accordingly we needed to explain this difference. In daily life, as is well known, distractives often are overcome by increased effort to attend. More particularly, I have shown cases where pressures were robbed of the inhibitory effect they

¹ *Op. cit.*, *Psych. Rev.*, Jan., 1911, §§ 4, 7, 18.

tended to have on sounds, when the subject attended to the sound as strongly as he could.² Indeed under these circumstances the sound sensation even seemed to be stronger than when it occurred with normal attention and no simultaneous pressure. These facts lead to the hypothesis that by added effort to attend to the odor when the sound came, the observers in the present series had counteracted the inhibitory influence of the sound, and so turned the scale as to result in a positive augmentation.

§ 4. *Introspections.*—Observers R and B had, in the work just described, spontaneously mentioned such effort to increase attention to the odor when the sound came; G and B each had done the same at least on one occasion. Partly in order to learn whether such added effort characteristically occurred with the sound under our conditions, I undertook to obtain a series of detailed introspective analyses of the situation. (See Appendix § 3.)

Of course the experimenter did not speak of effort to the observers. That would have been contrary to the policy of our introspective work, which requires that the observers be left to report on what they find without interfering suggestions. They were trained to give accounts of "everything that occurred in consciousness in temporal order" from the first signal to the utterance of judgement. Excerpts from these reports show how effort sometimes appeared when the sound came:

Observer B.—"Prolonged auditory sensation (from the buzzer). With it, I think, were kinaesthetic sensations in head and in back (meaning a brief, weak start). After this, but still with the auditory sensations, there came weak, unpleasant organic sensations (meaning disturbedness and *effort to image or sense the odor*)."

Observer G.—"Olfactory image or sensation, and simultaneous muscular sensations, principally in center of chest, and in the region of the nose and temples; also there were strain sensations in the chest and temples (those in the chest being due to holding the breath, and those in the temples perhaps due to holding breath, but also to *the purpose to keep out other stimuli than the olfactory*)."

Observer R.—"Kinaesthetic sensations in trunk, legs, neck, (movements to get odor) and scalpular sensations at the side of head and contracture sensations in forehead (concentration upon image of odor following). Meanwhile the image of odor and feeling of unpleasantness are present, but decrease toward the close."

The effort to attend, however, was only one of numerous kinds of effort which the reports mentioned and analysed: there also were efforts or strains to retain, judge, introspect, breathe, and listen for the experimenter's signal. Some one

² Ibid., Series 6, p. 48.

of these efforts was reported in each of most of the introspections, but the effort to attend failed to appear in very many of them, and furthermore, it often occurred during the tests in which the distracting sound was absent. These introspective reports, therefore, did not give adequate warrant to the conclusion that "added effort characteristically occurred with the sound under our conditions." (See above p. 349.) Nevertheless, they did give us positive instances of the occurrence of such effort, and we decided to test the matter further in the manner described in the next chapter.

PART II

The Abandonment of Effort of Attention

§ 5. *Methods*.—If the sound sensation in Series I was robbed of its inhibitory influence by special effort of attention on the part of the observers, we might expect, by doing away with this effort, to restore the inhibition. Plainly to tell them to avoid effort when the sound came seemed suggestive and unwise, and therefore the experimenter took a roundabout means. To each he first read a list of his past introspections, wherever they had mentioned effort, and then gave the following instruction: "Not to continue to exercise effort of any sort at any time during the entire process. To abandon all attitude of effort and be quite as passive as possible."

As it was necessary to learn how the instruction was working, in order both to understand and to control the situation, we made records not alone of the judgments about intensities, but of two other matters as well:

1. The observers gave introspective reports how the instruction was being carried out, telling especially of any effort that had been present. On some days they gave such an account after each eight judgments; on others, after the whole hour's work. Whenever any kind of effort was mentioned, the experimenter drew special notice to it, and suggested that it be abandoned.
2. The experimenter took records of the "behavior" of the observer.

It was plainly noticed that in this there might occur much variation: The observer's brows may be wrinkled, and his mouth compressed, or both may be smooth and expressionless; the muscles of his trunk and limbs may be alert and contracted, or they may be flaccid and inactive; he may breathe in the odors jerkily and utter judgment abruptly and vigorously, or may maintain the quietness of sleep and speak in a soft whisper; may talk in lively fashion, or may say practically nothing.

In short, he may be alert and tense in this or that part of the body, or may be inactive and relaxed.

Now it was found that with increase of effortlessness, as reported by the observer, there was an increase of relaxation and inactivity as externally manifested. Marked deviations were noted, but this correlation seemed to hold as a very rough, but fairly serviceable generalisation. And there seems to be a good reason why it should hold; for the observers all found that in order to carry out the *Aufgabe*, they had to 'relax'; and it is obvious that relaxation may be manifested in behavior as well as in introspection. In other words, effort is a psychophysiological condition which reveals itself not alone in certain mental processes (strain sensations, etc.), but in external behavior as well.

At first the records of behavior were taken sporadically, but later a system was developed. Then, as a rule, with every set of eight judgments the experimenter recorded the degree of (1) facial relaxation, (2) bodily relaxation, exclusive of the muscles concerned in maintaining the sitting posture, (3) jerkiness of respiration, (4) quietness of voice, (5) talkativeness. Sudden palpation was sometimes used to gauge bodily relaxation. The above particulars were each time recorded as of degree 0, 1, 2, 3, 4, 5, the last number representing the maximum. We give two examples, both of Observer E, the first taken when he had not yet had much practice in attaining effortlessness.—“The observer shakes his head, wrinkles his brow, and speaks in strong perplexed tones. He takes quick, irregular breaths, and his voice is no more calm than in Series 1.” A record from a later time, when he had become better at the task, shows him much more relaxed and inactive, to-wit:

f = 4
b = 4
r = 1
v = 2
t = 0

This schema made it possible to take records very quickly. The observers were never informed of this, since we wished them to be spontaneous. When activity rather than quietness and relaxation was shown, the observer was specially instructed and urged, in general terms, to increase his attempts to get the effortless condition. (See Appendix, § 4).

The odors were given in about the same way as in Series 1: Upon signal the observer took a half-second breath from the tube, practice having made this habitual; after removing the nostril he awaited the second signal, which came three seconds after the beginning of the first inspiration; then he took another half-second breath and said which odor was stronger. The sound occurred in one-half of the tests either with the first or second odor. (See Table I; also Appendix, § 5.)

§ 6. *Results*.—We shall first quote from the records in order to trace how each observer did away with effort.

Observer B.—At first B stated that the effect of the *Aufgabe* had been to remove “nearly all those efforts that you described in reading those introspections” (see p. 350). Nevertheless, the immediately

subsequent reports, including all of those for the first three or four hour-sessions, speak of effort. For example: "Sensations of strain about the neck, also vague strain sensations in head and at times in body occurred noticeably before giving the judgment 'Equal,' and also during sounding of the buzzer, especially when this appeared prolonged—and occasionally when the odor was not sensed as soon as the nostril was placed on the tube. These strain sensations are the same as those which constitute the greater part of the feeling of effort. When the buzzer comes there is a feeling of uncomfortable tension, which is particularly marked if the sound is prolonged. It is the sort of feeling that always produces bodily strain. Perhaps that is due to my trying not to attend to it; I don't know." At this time also the signs of behavior do not indicate effortlessness; there are "quick, jerky movements away from the tube, and his utterances are somewhat jerky and abrupt." A little later we still find him saying, "The whole period of the sounding of the buzzer is very different from other periods. There is a strong, unpleasant affection, and a consciousness of the presence of a disturbing factor; I feel confused, disturbed, uncomfortable, as if in an unnatural situation."

Marked improvement soon sets in; the breaths remain jerky, and there is still some muscular tenseness, but the signs are generally quieter. We read, "Very little feeling of effort, if any. Strains in body, arms, neck, forehead, eyelids, and top of head vaguely noticeable; I believe these are always present in some degree if attention is turned to them; but they are very obscure and appeared only when the idea, 'Am I straining?' came into consciousness. — Judgments seem to come much more mechanically than usual, and I have a positive kinaesthetic 'feel' of relaxation —." Relaxation (including the absence of strains localized in the brain) is stated by the observer to be equivalent to absence of effort (See Appendix, §6).

Improvement continues.—The muscles of face and body show a high degree of relaxation (degree 4, as a rule), respiration and voice are subdued, and talking is at a minimum. Reports read: "Felt perfectly passive," etc. "Seems to be no effort at all except very seldom.—Was conscious of vague pressures and strain—my self-consciousness,—but that is all." Indeed at this stage the observer has made so much progress toward passivity and effortlessness that he falls asleep at various times during the hour's work, especially at the pauses between the sets of eight judgments. Nevertheless the signals arouse him to go through the task and judge in mechanical manner. "The general dozing condition", he reports, "is made of distinct organic sensations in arms, legs and body (a definite, positive 'feel' of relaxation). There is a slight strain of different character in the back (meaning physical effort to hold the body in position relatively to the tube). The most intense sensations present come from the eyes, and are similar to the peculiar strains experienced when going to sleep; (these carry a meaning, 'My eyes are becoming closed,' entirely different from 'I am closing my eyes.' The former is very passive). Tactual sensations from weight of head on hand or other support (meaning relaxation) also are prominent. The whole of consciousness may be said to be rhythmical. Even breathing seems to be accompanied by rhythmic variations in the kinaesthetic complex.

"The acts performed in connection with smelling appear also to come rhythmically. Each one is preceded by vague visual and kinaesthetic images, which are followed by a slow motion whose time is felt kinaesthetically (image) beforehand. The motions following the

signals go off almost automatically. The verbal idea frequently appears 'I don't care what happens.' (The observer had been instructed that he need not concern himself about anything so long as he attains the desired state of effortlessness. He may even omit passing judgment if necessary.) This phrase is especially frequent when judgment does not follow immediately after the second stimulus.

"There are really two sorts of consciousness. In the dozing sort there is complete reverie. Consciousness does not lapse, but may lose all logical connection and all reference to the surroundings and the situation. At the first signal there is a feeling of 'heightening' of consciousness. By this I mean that I have a visual image of raising something up in my brain. There are also kinaesthetic images or sensations in the shoulders, and a slight feeling of restlessness and constraint carried by kinaesthetic sensations in the head. I have not called this effort in the past; it is too vague and uncertain, and is more of an attitude than a separable component. When judgment comes of itself I lapse immediately into a state of reverie with a few kinaesthetic changes. If judgment does not come at once, there is a feeling of suspense carried kinaesthetically in the chest and elsewhere and followed by judgment, or sometimes, in the event of failure to get judgment, by the utterance 'equal.'"

A final statement of the observer shows further how he did away with effort. "Effort is very likely to occur when the attention is not on the matter in hand, but may be inhibited, I think, for instance, by the phrase, 'I don't care what happens,' or 'I don't care whether I judge or not,' since in these last series I knew that if necessary, I did not have to bother to judge. Sometimes the idea 'I must not make any effort' increases effort. (Question: In attempting to abandon effort did you make any use of effort to attend positively to something else?) No! (with certainty) to attempt to attend positively to anything else means to me to attend with effort. On the other hand, I frequently did avoid effort by attention to something else, but the attention did not come voluntarily; there was no attempt to attend."

Observer G.—The first report reads, "Before the signal 'Ready' I was more relaxed (than in the previous series); did not thrust back any ideas trying to come in. After the signal things seemed to be as usual, except that there was muscular relaxation more or less all over, but especially in the head and temples; and in the period between the odors there was not such strain as usually occurs." From now on G typically gives a brief report, in which she compares her present condition with that of the previous series: "1. Greater muscular relaxation. 2. Ideas not relating to the task occurring in the fore- and mid-period were not actively thrust back. 3. I felt a 'tightening' at times, which I at once tried to banish." The reports for most of the periods practically are repetitions of the above, some of them omitting (3). (See Appendix, §7.)

As to behavior, moderate or good facial relaxation with deliberate breathing and subdued voice was attained, but there was more or less retrogression at times to the quick reactions that characterized the previous series. Towards the last the observer reported maximal relaxation, and at this time an average of four behavior records reads $f = 3$, $b = 3$, $r = 4$, $v = 3$, $t = 2$, showing a fair, but not an exceedingly high degree of external relaxation.

Asked for a brief and general account of how it felt to go through the process in the relaxed state, the observer replied, "Before the first signal I got the conditions, and remained more or less conscious of the

relaxation and calmness during the experiment; with these exceptions consciousness, so far as I remember, was the same as in the previous series." Her way of bringing about effortlessness, she added, was by keeping her hands from being clenched and tense, by eliminating strains from the head, and by making her body as limp as possible. Questioned how she 'banished the tightening' she replied that all she could say was that she just relaxed again; "It involved a consciousness of being tense, and that I must not be tense,—not verbally spoken, of course."

Observer E.—He discusses his first response as follows: "At first arose the verbal idea, 'relax!'; I found an easy position and tried to get as comfortable as possible; so far as I could I relaxed all muscles, then waited to let my ideas or sensations appear. Attitude was that of one ready to follow the impulse of the moment. I noticed the comfortable feelings of breathing and having eyes closed, and the pleasure which came from allowing my thoughts to arise without any effort, unlike the past." On the next day he adds that smelling and judging occurred quite mechanically. The behavior, however, does not indicate effortlessness and passivity, and special instructions to get this condition are repeatedly given. On the fourth day muscular relaxation sets in, though other signs are of normal activity; but his introspections do not change in tone. Various sorts of effort are reported at times, but usually the operations are called automatic.

Once he remarked, "The noise was very unpleasant. I did not set myself to overcome so much noise." Questioned as to the nature of this 'setting,' he replies, "First a consciousness (of the task, namely, to be relaxed as much as possible and still to smell and judge upon signal. This becomes relatively unconscious, and the appropriate act automatically follows the signal.)" At the time he was unable to analyse this consciousness. Later he speaks more definitely when asked, "What happens when the buzzer sounds?"—"Auditory sensations of noise, generally in the background of consciousness,—not much noticed. Muscular sensations in chest (from slight effort to overcome distraction caused by buzzer). Also organic sensations, not definitely localized, (but due to shock and intensity of noise). A slight tightening of diaphragm, I think, (also due to shock). There is rather more effort when the buzzer sounds, as shown by these muscular sensations, which are not so apparent without the sound." (See Appendix, §8.)

The factor whose presence we suspected is here plainly disclosed for this observer; and at this late date, when more than half the series is over, has not yet been banished. He had believed that he could not judge at all, if this effort during the noise were banished. Upon this the special instruction was given that he abolish it, and after some trouble he reports success. The typical report for the last part of the series is, "No effort recalled." (There is no corresponding decrease of activity shown in behavior, but rather a slight increase on the whole in muscular tone. However, the signs show a fair degree of relaxation and inactivity,—averaging $f=3.5$, $b=4$, $r=1$, $v=2$, $t=7$.)

The records for the three observers may in summary be said to have seven essential elements in common: They find (1) various kinds of effort, and among these (2) special effort to attend when the buzzer sounds. (3) Effortlessness is

identified with relaxation, and (4) the state is brought on by self-imposed instructions such as "Relax!" or "I don't care what happens!" carried verbally or otherwise. Then (5) effort diminishes and external relaxation and inactivity increase, until towards the close of the series (6) a high degree of effortlessness is attained, and (7) the processes of smelling, attending, and judging become mechanical and automatic.¹

For each observer, therefore, the attention to the odors finally becomes fairly passive and effortless, and special concentration to overcome distraction is probably abandoned.

How have the reported intensities of the odors thereby been affected? Turning to Table III, one is disappointed, if he has expected to find evidence that the sound now exerts a marked inhibitory influence. In the case of G it seems to have been inhibitory, as shown by the sums at the bottom of the table; but for B the effect, if any, has been small, while for E it has amounted to nothing.

Upon comparing Table III with Table II, however, it is seen that there is some difference. While the "Total Sums" in the latter for each observer excepting G show a decrease from left to right, that is, an augmentation of the reported strength of the odor, those in the former show no decrease, but rather a constancy or increase. Consistently with this, the increase (inhibition) for G in Table III is greater than the increase in II. It seems fair to conclude, therefore, that the decrease or augmentation in II probably was due to "added effort of attention in order to counteract the inhibitory influence of the sound," since upon removing this effort (at least partially at all stages) in Series II, that decrease disappeared.

However, the fact remains that the figures of the table do not demonstrate the general occurrence of inhibition of the odor sensation by the sound. We are reminded of the results of previous workers on distraction, who have failed to secure that condition under circumstances that made it expected. What makes our results almost astonishing, however, is that the inhibition did not occur when conditions were rendered so favorable.

We have attempted to carry out the conditions required for efficient distraction, as we previously defined them (*op. cit.*, p. 42). But it is possible that in one respect we somewhat failed. For upon exhalation through the nares a second olfactory stimulation sometimes causes a noticeable sensation, if attended, and this I did not take into account when I

¹ G does not mention points (2) and (7); this may be due to omission, since her reports in this series lack fullness.

TABLE III.

		Observer B		Observer G		Observer E	
A	C	6	5	6½	6	7	7
B	D	4	6	5	7	5½	4
A+B	C+D	10	11	11½	13	12½	11
E	G	4	6	3	5	3	4
F	H	2½	2	1	4	1	½
E+F	G+H	6½	8	4	9	4	4½
A+B+E+F C+D+G+H		16½	19	15½	22	16½	15½
A	C	7½	4½	6½	6½	6½	7
B	D	4½	4½	2½	6	6	5½
A+B	C+D	12	9	9	12½	12½	12½
E	G	4	4	1½	4	3½	4½
F	H	2	3½	2½	4	½	0
E+F	G+H	6	7½	4	8	4	4½
A+B+E+F C+D+G+H		18	16½	13	20½	16½	17
A	C	6	5	7½	4	5½	6½
B	D	6	5	4½	5½	4	4
A+B	C+D	12	10	12	9½	9½	10½
E	G	5	5½	1½	3	2½	3
F	H	2	7½	1	1½	1	1½
E+F	G+H	7	13	2½	4½	3½	4½
A+B+E+F C+D+G+H		19	23	14½	14	13	15
A	C	4	6½	6	7½	½	1½
B	D	6½	6½	4½	1½	6½	5
A+B	C+D	10½	13	10½	9	7	6½
E	G	4½	3½	6½	4½	4½	2½
F	H	4	1½	2	3	2	1
E+F	G+H	8½	5	8½	7½	6½	3½
A+B+E+F C+D+G+H		19	18	19	16½	13½	10
Total		Total	72½	76½	62	73	59½
						57½	

planned the conditions. Nevertheless, there are two reasons for supposing it has not the greatest importance: first, since only one observer noticed it, and then said that it occurred but seldom; secondly, since we succeeded in getting inhibitions in Series III, as we shall presently describe, although the manner of exhalation remained the same.

We have not exhausted all resources for bringing about an inhibition of the odor by the sound. There remains one manner whereby we can increase the efficacy of this as an inhibitor to the maximum, and to this we now turn.

PART III

The Inhibition of Olfactory Sensations by Strongly Attended Sounds

§ 7. *Methods.*—Our aim was to learn whether the sound, when given the advantage of strong voluntary attention, would cause marked inhibition of the odor. If so, this would be like our previous results, where strongly attended sounds had inhibited pressure sensations, and conversely.¹

To do this, we find the number of times out of eight that the sensation from stimulus C accompanied by a strongly attended sound is called fainter than the sensation from S; also we find the number when C is not so accompanied, but receives normal attention. Thus we learn whether the attended sound increases the number of times that C is called the fainter. This plan was followed with four strengths of stimulus in the rôle of C, as Table IV makes clear. For S a constant stimulus was used in all cases for each observer, and the sensation was always attended in the natural manner.

TABLE IV.

	Observer B		Observer G		Observer E	
	First Odor	Second Odor	First Odor	Second Odor	First Odor	Second Odor
A	5	9	5	9	5	9
B	10	9	10	9	10	9
C	14	9	14	9	14	9
D	18	9	18	9	18	9
a	5/ <i>n</i>	9	5/ <i>n</i>	9	5/ <i>n</i>	9
b	10/ <i>n</i>	9	10/ <i>n</i>	9	10/ <i>n</i>	9
c	14/ <i>n</i>	9	14/ <i>n</i>	9	14/ <i>n</i>	9
d	18/ <i>n</i>	9	18/ <i>n</i>	9	18/ <i>n</i>	9

The figures stand for strengths of stimulus. The sound is represented by *n*. (In the last third of the present series we changed the strength of the second odor for Observer B from 9 to 6.)

Eight pairs of odors, along with repetitions, were given in succession, followed by a pause for rest. Before some sets the observer was told that the coming odors were to be compared and judged in the natural and ordinary manner; before other sets the instruction was as follows: "The sound will come with the first odor, and you are to put the most intense concentration you can on the sound. The second odor is to be attended in the ordinary way."

¹ Ibid., pp. 41-48.

§ 8. *Results.*—From the introspections we shall first quote accounts of the act of strongly attending the sound. Analysis shows that it involved various factors, differing from time to time.

Observer B.—"Concentration on the sound consists of clear auditory perception of the sound plus a visual image of the buzzer sometimes, plus kinaesthetic strains in head, ears, neck, sides of chest and elsewhere; probably also organic sensations in the trunk." So read his first report. He succeeded in carrying out the task from the start, excepting that at first he found that perfect concentration interfered with his withdrawing the nostril at the proper moment. He got rid of this difficulty by conceiving each time that the sound was caused to start by his act of placing the nostril on the tube, and caused to cease by its withdrawal.

Later on he adopts a similar device to help him attend to the sound. He will press on the table with his finger, he says, and the pressure will carry the meaning for him, "This is going to make the sound come." We can note the rôle of this and other elements in a report given at an advanced stage of the work. "In general, concentration on the sound came more easily than heretofore:—Auditory perception of the buzzer was clear sometimes, not very clear at others. There were kinaesthetic sensations in the right hand and fingers (meaning, 'I am pressing to make the buzzer sound.' The meaning just now was not so evident as it was earlier today, and has never been verbal today). The kinaesthetic sensations in the fingers last after the pressure sensations have become unclear, while muscular and kinaesthetic sensations in the chest, neck, left ear, cheek and shoulder (mean effort to attend to the buzzer; they also very vaguely mean the location of the buzzer, and occasionally become focal and mean 'I am leaning or trying to lean toward the buzzer'). Generally all these kinaesthetic and organic sensations are not very clear, though sometimes a particular one or a number of them stand out. When these are not clear, the clear process is either auditory sensations or visual image of the buzzer. Also there are very vague, never clear organic sensations in the head (which mean that the odor is present, but attended from,—like a feeling of bewilderment)." Much later we are told that the "pressure in the left hand is scarcely noticed any more, and occurs almost automatically, except after failure to concentrate." The factor is still mentioned at times in subsequent reports.

Of the period preceding the sound, an early report says: "I begin by calling up auditory images of the sound, and a visual image of the buzzer; the body is made tense, principally in the sides and back. In listening, strains of two kinds arise about the ears,—a sharper one on the pinna, and a duller and less intense one in the ear deeper than the external opening." Other reports show that all of these elements, excepting the auditory image, may also appear during the sound.

It is clear from the above analyses, as well as from many others which we have not the space to quote, that there are divers elements which enter into the act of concentration, namely:—

- (1) Clear auditory perception of the sound. (See Appendix § 9.)
- (2) Visual image of the buzzer sound.
- (3) Auditory image of the sound.
- (4) Kinaesthetic or 'strain' sensations about the ear (meaning attention to the sound).

(5) Kinaesthetic sensations in hand and fingers (meaning, 'I am pressing to make the buzzer sound').

(6) Tactual sensations, etc., (due to placing nostril on tube, and meaning that the sound will thereby be started).

(7) Kinaesthetic or 'strain' or 'organic' sensations in neck, trunk and limbs (mean effort to attend to the sound). (Appendix, § 10.)

(8) Organic sensations in the head and strains in upper parts of the trunk (effort not to attend to odor). (Appendix § 11.)

Observer G.—In the first report, in answer to the question, "What occurred when you concentrated on the sound?" it was said, "Muscular or strain sensations shifted from the region of the nostril to that of the ears. The sound stood out more in consciousness, as a rule, than the odor." Another report reads, "To get attention on the sound, I had strain sensations principally in and around the ears, especially the left. There were also strain sensations in the upper part of the head. These strain sensations were accompanied by the feeling that I must have my attention on the sound. Rarely the phrase, 'Sound!' or 'I must get the sound!' was present."

These reports, along with several others of similar tenor, do not enable us to enumerate as many factors as those for *Observer B*; certain other of her accounts mention various sensations due to tension in the arms, legs or trunk, but it is not made clear whether these are integral parts of the concentration on the sound or merely of the general attitude.

(1) Clear auditory perception of the sound.

(2) Muscular and strain sensations about the ear.

(3) Strain sensations in the temples or upper part of the head.

(4) Verbal idea, 'Sound!' or the like.¹

¹The *Aufgabe*, we are told in the first report, was kinaesthetically rehearsed before each pair, "a shorthand anticipation of the whole process to be gone through,—the clearest part being strain sensations in the ear, with the accompanying feeling that the sound was to come first in the experiment, and strain sensations in the nostrils, with the feeling that smelling was the second thing. Sometimes, there was internal speech, 'Sound—odor'. Soon the matter becomes more automatic, but some strain persists right along."

In the above list of elements or parts of the act of concentration, we do not include everything that appears in the *Aufgabe*-consciousness. Rather, we distinguish between act of concentration and *Aufgabe* to concentrate as we would distinguish between 'effort' and 'feeling that I must exert effort'; the latter may be mere intention. To be sure, the consciousness of *Aufgabe* often is more than mere intention,—is itself an actual incipient effort to concentrate. Therefore the line is hard to draw and error may creep in.

Observer E.—In reply to the question, 'What happens during concentration on the sound?', a typical report from *E* reads thus: "Strain sensations in the eye-muscles (from moving the eyes toward the buzzer and from holding the eye-lids pressed on the eyes); also bodily sensations (from a muscular set in the trunk, head and neck generally, which carried the consciousness of the task to attend strongly to the sound); also sensations from changed breathing, which probably come from the body being held somewhat more tense."

From many such reports we abstract the following factors concerned in *E*'s concentration:

(1) Strain sensations about the eyes, and also sometimes in the

forehead and cheeks (from incipient turning of the eyes toward the buzzer).

(2) General, faint strain sensations in head, neck and trunk (they arise from a muscular set and are called by E the physiological accompaniments of attention to the sound).

(3) Vague visual image of the buzzer.

(4) Verbal kinaesthetic repetition of instruction, sometimes occurring as a memory image.

(5) The sound sensation is in the focus of consciousness; compared with what it was in the former series, it is more clear, its details and variations are more conspicuous, and it appears nearer at hand.

Having shown the nature of the act of strong attention to the sound, we turn next to inquire about the odor. How, according to the reports, was it affected in quality by the sound, and how was it attended, if at all, and how remembered? The reader is urged to have these questions in mind as he reads the following excerpts from typical introspections. In order to help him, we will first give a brief summary, of which the introspections may be taken as illustrations and extensions.

For B the odor may quite fail to appear during good concentration on the sound,—at most it is present without being clearly perceived; similarly for B it is not clear; but for E after some delay it arises clear and ‘near the focus, though just outside.’ Specific processes of attention to the odor are lacking, owing to the predominance of attention to the sound; this is true for B and G and at least in some measure for E.

The odor is referred to and remembered by an olfactory image, organic sensations, a kinaesthetic set, or visual images, that is, variously for each observer. The sound does not change the representation, except that in the case of B the processes are often much delayed.

Observer B.—“During the sound there are organic sensations in chest (?) and in head (?), which mean that the odor is present;—I am conscious of the odor, although not clearly conscious, for I do not know its intensity or quality. There are very strong organic sensations deep in the upper part of head, and also less strong muscular (?) sensations elsewhere (due to disturbance of respiration); both of these together mean effort not to attend to odor.”

Various other reports read quite similarly, e. g.: “The first odor varies greatly in clearness. I think there are at least two degrees of unclearness. The most unclear is hardly an odor sensation at all (if at all). However, there are organic sensations in the head (due to pressures) and less clear strains in back of neck and shoulders (all mean a pulling of the head away from the tube, or bracing it against force from the tube; also they carry the meaning, “The odor is present”). In this case I have no idea of the intensity of the odor until it is gone. Then appears an image of the odor with a more or less definite intensity. (Definiteness depends on clearness of image.)

“When the odor is actually recognized as such during successful concentration on the sound, it is vague and unclear, and varies in

intensity, generally becoming clearer toward the end. It has a certain intensity, though fine distinctions are not evident. —"

Later the observer comes to doubt very strongly that any odor appears at all when there is good attention to the sound; at any rate if it is present, he has no memory of it when he reports. After making further special observations on this point he decides that during some tests the odor is vague and unclear, while in others it quite fails to appear during the sound.

At most, then, the odor is vaguely present and dimly referred to by organic sensations. In contrast therewith we recall this observer's reports in Series I, where processes of attention to the odor characteristically occurred. For example, "Organic sensations in the head and probably also in the body (meant effort to attend to the odor and to judge). Next came the olfactory sensation and, I think, a very vague, pale yellow image of the odor with the inside of the nostril as background. Then—general organic sensations arose (meaning effort to attend to the odor)—" etc.

Returning to the present series, we find that attention lapses to the odor only when the concentration on the sound is not successful. Then the odor "is clearly sensed in quality and intensity, and an 'absolute' judgment of intensity—generally in visual terms followed by verbal, but sometimes without the former—appears at once."

Another report, typical of many others, dwells on the rôle of feelings. "Sometimes organic sensations deep in the head mean that the odor is present. Occasionally the odor is sensed very vaguely and unclearly; I think I know that this is true only by a feeling of familiarity when I later recall the odor.

Ordinarily the odor comes up after the sound stops as an unfamiliar thing. There is a feeling of its unreality carried by certain organic sensations in the trunk. On the other hand, if concentration is not successful, the odor lasts over with a feeling of familiarity, but none of unreality. In this case there are feelings of exasperation, etc., organically carried."

We have room to quote only one typical report concerning the perception of the intensity of the odor. After taking the first breath and removing the head there were "organic sensations in the head and elsewhere and a vague visual image of a misty yellow field (?) with a bright spot in it (this meant 'I must get the odor,' the latter being represented by the bright spot). Next the olfactory image or sensation came in clear (representing the odor, of course). With this there was a visual image of a hazy yellow field plus organic sensations in the trunk (representing the intensity of the odor). At about this time the buzzer ceased."

This mode of representing the intensity of the odor is quite characteristic of this observer. But one important difference has been caused by the sound: the representative processes have been much delayed. When the sound is absent, they arise about at the time of inspiration, along with the odor sensation; but in the last quoted report the intensity of the odor is first represented at a comparatively late time, namely, considerably after the head has been withdrawn from the tube.

Observer G.—"When the auditory sensations were in the focus of attention, the odor was at a lower level." The odor, that is, appears on time, but is relatively unclear and unattended, because of the sound. "Muscular or strain sensations, instead of being around the nostril, shifted to the region of the ear," says an early report.

Little is said about the remembrance of the odor. Shortly after the odor has arisen, and while the sound is still in progress, there comes "a general organic feeling, which seems to stand for odor."

Observer E.—"The odor was generally clear; that is definite and clean-cut, of pleasant character and giving a feeling of certitude. This attitude can be analyzed into weak kinaesthetic sensations, not localized, accompanied by a pleasant affective coloring.—The sound has the focus of consciousness, but the odor is just outside of the center." Again, "the olfactory sensations come into consciousness, but seem never to get so near to the focus as do the auditory sensations." Later reports often agree that as the sound stops, the odor attains greater clearness; indeed, "they often become quite clear while the auditory sensations continue." This fair clearness of the odor makes it seem possible that there were specific processes of attention to the odor; but the observer did not mention them, so that they were probably not prominent; as no special question was put to him on this point, the matter remains in some doubt.

Let us pass on to another matter.—The memory of the first odor is once reported as having been carried by an olfactory after-image; but as a rule, the observer says, it is carried by 'a kind of kinaesthetic set.'

TABLE V.

		Observer B		Observer G		Observer E	
A	a	5 $\frac{1}{4}$	8	5	5 $\frac{1}{2}$	4 $\frac{1}{2}$	4 $\frac{3}{4}$
B	b	3 $\frac{3}{4}$	7 $\frac{1}{2}$	$\frac{1}{2}$	5	3 $\frac{3}{4}$	2 $\frac{1}{4}$
C	c	2 $\frac{1}{2}$	5 $\frac{1}{4}$	1 $\frac{1}{2}$	3	$\frac{1}{2}$	$\frac{1}{2}$
D	d	2 $\frac{1}{4}$	7 $\frac{1}{4}$	2 $\frac{1}{2}$	1	3 $\frac{3}{4}$	2 $\frac{1}{4}$
Sum		13 $\frac{3}{4}$	28	9 $\frac{1}{2}$	14 $\frac{1}{2}$	12 $\frac{1}{2}$	9 $\frac{3}{4}$
A	a	3 $\frac{1}{4}$	7	4	4 $\frac{1}{2}$	4 $\frac{3}{4}$	5 $\frac{1}{2}$
B	b	3 $\frac{1}{2}$	7 $\frac{1}{4}$	$\frac{1}{2}$	4 $\frac{1}{2}$	3	3 $\frac{1}{2}$
C	c	2	6 $\frac{1}{4}$	$\frac{1}{2}$	2	3	1
D	d	4 $\frac{3}{4}$	6 $\frac{1}{4}$	$\frac{1}{2}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{4}$
Sum		14	26 $\frac{3}{4}$	5 $\frac{1}{2}$	14 $\frac{1}{2}$	13 $\frac{1}{4}$	13 $\frac{1}{4}$
A	a	4 $\frac{1}{2}$	6 $\frac{3}{4}$	5	7	4	5
B	b	4 $\frac{1}{2}$	6 $\frac{1}{2}$	1 $\frac{1}{2}$	7	3 $\frac{1}{4}$	2 $\frac{1}{4}$
C	c	2 $\frac{3}{4}$	5 $\frac{3}{4}$	2	6 $\frac{1}{2}$	1 $\frac{1}{2}$	3
D	d	3 $\frac{1}{2}$	5 $\frac{1}{2}$	0	4 $\frac{1}{2}$	3 $\frac{1}{4}$	0
Sum		15 $\frac{1}{4}$	23 $\frac{1}{2}$	8 $\frac{1}{2}$	25	12	10 $\frac{1}{4}$
Total		43	78 $\frac{1}{4}$	23 $\frac{1}{2}$	54	37 $\frac{3}{4}$	33 $\frac{1}{4}$

For explanation of the table, see text. (See also Appendix, §§ 12 and 13.)

Now let us turn to our results in Table V. Considering those for Observer B, we have in the first column the number of times out of eight that C was called fainter than S, no sound

being given.¹ In the second column, the number of times that C was called fainter when the strongly attended sound occurred with it. It is evident that the values in the first column are considerably less than those in the second. C is called fainter more often with the sound; its intensity is reduced by the sound.² The results for Observer G are similar; those for E are different and require special discussion.

§ 9. *Discussion.*—First let us return and consider the list of elements of concentration given for Observer B (p. 358). Of these the visual and auditory images of the sound may clearly be classified as representative processes. Here we are reminded of Helmholtz's pre-imagination, of Lewes' preperception; we are confirming the views and experiences of previous writers. On the other hand the strain sensations about the ears and the kinaesthetic sensations in neck, trunk and limbs obviously are something more than merely representative in character; they indicate effort; they are motor adjustments to the sound. Here again, we are reminded of previous opinions; of Fechner's strain sensations, and of Müller's *Spannung* and *Anstrengung*. We come upon something new, however, in the observer's act of pressing upon the table to make the buzzer sound; and what is quite similar, his conceiving that the sound was caused to start by his act of placing the nostril on the tube. These acts are motor, but nevertheless they are also representative. And it is evident that it is by virtue of this representative character that they make the sound better attended. The observer deliberately associates the experience of placing the nostril on the tube with the sound, thereby doubtless severing its connection with the odor; thereafter the experience of placing the nostril on the tube suggests the sound and not the odor. The working of all representative processes clearly is to suggest the impression they represent; the process is one of "associative co-excitation."

If we compare the present series with Series II, where the attention was passive and effortless, we find in the latter very much less of these activities of representation and effort. The observer is not voluntarily attending to the sound, and the sound is less clear in consciousness. It is evident, therefore, that we were justified in considering the elements above dis-

¹ Refer to p. 346 and to Table IV.

² We do not mean that the sound has each time reduced the odor just so much; rather there is every evidence that the effect is very irregular. All that our figures permit us to conclude is that in the long run a considerable number of inhibitions occurred; that is, the odors would on the whole have had greater strength but for the sound.

cussed as essential parts of strong voluntary attention. In order to give them all a name, including the efforts and strains and the images as well, we note their property of making the sound prominent, of bringing it forward in consciousness; accordingly we shall call them 'adducent processes.' Now, what we wish to emphasize is that our results show that voluntary increase of the attention partially consists of increase of such adducent processes and that it is wrong to give them a minor or negligible place in a theory of attention, as is usually done.

According to E's reports the olfactory sensation during the sound was definite and clear, and though not focal was nevertheless nearly so. This is in sharp contrast with the cases of G and B and perhaps is the key to the difference of the results.

It is certain that the sound was strongly attended by E and we may assume from our results that the odor was nevertheless not inhibited. Neither, as the reports show, was it considerably less attended than when the sound did not occur. To generalize this result would be only to say that increase of attention to one impression does not necessarily bring inattention to another. The inhibitory effect need not in all cases occur,—unless that increase of attention be very great. Where it does occur, we may suppose, it is because the adducent processes for the one impression render impossible the other or inhibited impression. We do not suppose, that is, that under conditions like ours one sensation inhibits another by a direct or immediate action upon it, but rather by way of intermediate processes, those namely, which we have called adducent. Hence the unreliability of obtaining an inhibition merely by increasing the intensity of one impression or by increasing the attention to one impression; for whether this will bring with it that decrease of adducent processes required for inhibition is variable for individuals and for the particular mental complex of the moment.

§ 10. *Summary.*—In the first series we found that the strength of the odor sensation was not generally lessened by the sound; but rather it was increased for three observers out of the four. As there were indications that the distraction was being counteracted by effort of attention to the odor, the observers were next trained to abandon all effort. They found that the desired state was one of mental relaxation, and gave many analyses of this condition. But while the sound was now given a better chance to work upon the odor and

thus no longer lead to augmentations, it nevertheless still failed to produce marked inhibition.

Upon this, the observers were drilled in concentrating upon the sound as strongly as they could. Then the odor sensation generally suffered an inhibition, for two observers out of three. Analysis showed that the increased attention to the sound, upon which the inhibition obviously depended, consisted of representative and other processes associated with the sound, and to these the name 'adducent processes' was applied. The inhibition of sensations was thus found to be intimately bound up with adducent processes.

APPENDIX

§1. (Refer to p. 346.) The buzzer was placed in a box about 10x17x9.5 cm. in dimensions, the side next to the observer being open, and at a distance of 5 cm. from his left ear.

The olfactometer was clamped to an iron stand and adjusted to the height of the observer. It was fitted with a very large black screen, which served to shield the observer from odors as well as to conceal the operations of the experimenter.

For G we used beeswax, for E, India rubber, and for B and R, the combination of gum ammoniac and gutta percha. The last became weak after Series 1 and we obtained new ones from C. H. Stoelting Co., Chicago, which had a different quality of odor.

§2. (Refer to p. 347.) Concerning the time periods we note five points:—

1. We attempted to make the interval between the two odors to be compared fairly constant for each observer for every set of comparisons. (The signal to take the second breath was given a constant number of seconds after the beginning of the first inspiration.)

2. In order to equalize the periods of stimulation for the odors to be compared, the observer was given practice in making the second breath like the first. When deviations were noted we did not count the results.

3. In the process of smelling the observers at first took breaths of natural duration; but afterwards special drill was given in order to reduce the period, since we thought that we might more easily demonstrate inhibitions if we used brief sensations. (In Series 1-D, shown in Table I above, this period is one-half second for all observers; in 1-A, 1-B, and 1-C other, longer periods were used.)

4. Considerable effort was made to begin the sound at the instant when he breath commenced. (In this the experimenter was guided by the movements of muscles of the face and chest, by the sound of inrush of air into the nostril, and by learning with each observer how soon after the nostril was placed over the tube and in what position it was when he commenced to breathe.)

5. The sound always lasted at least as long as the inspiration. (After Series 1-A it always lasted longer,—in 1-D 1½ seconds longer for all observers.)

Various other measures were taken to secure regularity of procedure, with the avoidance of error and disturbance:—

1. Eight pairs together with the necessary repetitions were given

in succession, followed by a pause for rest. As a rule for every A, B, E, and F there was a corresponding C, D, G, and H, respectively,—terms which are explained under Table I above. This was important because we thus got all the things we needed to compare into the same hour, and could therefore fairly disregard changes in subjective and objective conditions from day to day.

2. To avoid exhaustion, no more than 24 or 32 pairs of odors (not counting repetitions) were given during a single hour.

3. A clean tube was used after every eight judgments,—not counting repetitions, however, which were very frequent. Tests showed that with our odors, this rate of change was satisfactory. (The tubes were washed in a solution of mercuric chloride, an antiseptic which is superior to listerine because it is odorless. They were dried with cotton, and then heated in the flame of an alcohol lamp. In Series I we heated all just before the hour's work, but as this led to the collection of moisture we later abandoned the practice, and thereafter a tube was not put into the flame until we were ready to use it.)

4. A quiet room was used for the work. When unusual noises occurred we generally stopped or did not count the results. (Our reason for strictness lay in our previous experience that noises may affect the judgment without the observer noting this fact as such. Unfortunately our conditions were often imperfect, for there were times during the winter when we had to work with a continuous but faint rustling sound from the radiator, or with stronger noises from the wind outside.)

5. Repetitions were made (unknown to the observer) when unusual noises occurred, and whenever there was marked irregularity or disturbance. Also when the observer reported 'doubtful.' (Repetitions were frequent, though not the rule. In extreme cases a pair had to be repeated four times or more before the observer was satisfied with his judgment. The observers were cautioned to distinguish properly between the terms 'doubtful' and 'equal'.)

6. The experimenter gave the signals with no trace of suggestion in his voice. Also he took care to move the cylinder noiselessly over the tube when he changed the intensity, the observer assisting by calling attention to occasional failures.

7. To avoid suggestion, the aims and principles of the work were not mentioned to the observers, and they refrained from discussing the experiment with each other.

8. Drill was given to avoid expiration into the tube. (Failures were frequent and sometimes we had to stop work and give special practice.)

9. In order to escape unnecessary bodily activities, which might act as undesirable distractions, the observer customarily sat forward with eyelids lowered or closed, and nostril very near the tube, while he awaited the next signal.

§3. Since we quote many introspective reports in the present paper, we refer the reader to a recent article for description of technique which was, with some differences, the same as that herein employed (On Meaning and Understanding: this *Journal*, Oct. 1911. 1. *Introduction*, omitting (3) on p. 555). We may add that the observers were given special drill on the 'stimulus error,' on the distinction of different qualities of sensation in the various regions of the body, on attentional clearness, on the distinction between 'process' and 'meaning,' and in giving detailed descriptions of all the conscious

events as they took part in temporal order in the total process of preparing to smell, smelling, awaiting signals, judging, etc.

§4. (Refer to p. 351.) It is often difficult in describing the conditions of a psychological experiment to name all the factors that were effective in bringing about the attained results. Items of some importance are likely to escape notice. In this connection, we may take note of various elements present in this series in order to suggest to the observer the desired attitude: Signals were given in a quiet whisper, the experimenter tried to be deliberate and noiseless in his movements, and also by his general demeanor to impress the *Aufgabe*; the observers, on their part, undertook the difficult task with much earnestness, and continually tried to get or keep the desired condition. Before each set of eight comparisons, or oftener, the general instruction was always given, though usually abbreviated to a simple phrase such as "Your passive attitude!" The observer was advised to omit introspections in case preparation for these in any way interfered with the attainment of effortlessness.

§5. (Refer to p. 351.) Upon investigation I found that the observers generally had been judging intensities of sensations, not of stimuli (See L. J. Martin and G. E. Müller, *Zur Analyse der Unterschiedsempfindlichkeit*). As to the previous work (*op cit.*), I cannot say with certainty on this point. The difference between the two kinds of judgment is one of intentional reference;—one intends to judge stimuli, or on the other hand, sensations. Under our conditions the influencing factors are virtually the same for both kinds of judgment, so that there is no tangible difference in results, whichever reference is made.

§6. (Refer to p. 352.) Nevertheless, with an inconsistency that he admitted but could not resolve, he analyzed the feeling of relaxation into a complex of strain sensations.—"Was conscious of strains deep in the head, in the hands, legs, and trunk. I customarily describe myself as absolutely relaxed and comfortable while experiencing these strains. They seem to be merely those sensations that enable me to be conscious of my body at any time that I attend to it. They also form the positive element about relaxation that makes it possible to feel positively relaxed." At a later time he describes these 'relaxation strains' as "intermittent, thrilling sensations, very diffuse and vague, and generally pleasantly toned, having a general location but difficult to localize particularly, similar to sensations of nervousness, but entirely different from the 'dead weight' sensations that occur upon letting the arm fall."

· §7. (Refer to p. 353.) On the fourth day of work the observer said that attention seemed less good than in the previous series. At the end she said that on the whole confidence in accuracy of judgment had been a trifle less.

§8. (Refer to p. 354.) To be considered with the foregoing are his replies to two questions.—What do you do when you attend to the odor? "(I hold the chest muscles more tense, and eliminate all movement except that required for the experiment); I often visualize the tube, stimulus, etc; also I generally have either an auditory memory image of the task or kinaesthetic sensations which mean the task and which produce a kind of set in which olfactory sensations are the things sought. This set seems somewhat to inhibit other things from coming to the focus of attention." He could not locate this set, but

said that it involved no effort. There was "slight effort in holding tense the muscles of the chest, but none in getting the auditory memory, or the visual image of the tube. This is all the effort I notice in the entire period, except that required to place the nostril over the tube, and to move the lips and tongue in giving judgment." Secondly, he was asked how he understood the term, 'effort'? "Something in addition to the automatic mechanical working:—Kinaesthetic sensations on either side of the chest carry the idea (of the end, namely, to breathe), which may be fairly clear or in the background of consciousness. Also there may be a vague auditory memory image (of the instructions) in the background."

§9. (Refer to p. 358.) We are not here trying to distinguish between perception and sensation, for the observers have not been drilled on this point. (Cf. this JOURNAL, Oct., 1911, 558).

§10. (Refer to p. 359.) We intend (7) not as a label for a particular experience, but as a rubric. Several experiences already mentioned fall under it, and we will here give two more instances. "——strains and muscular sensations in arms, hands, head and neck (mean effort to attend to the buzzer, or determination to succeed)." Again, "muscular sensations in left side of trunk and left side of head, strong tactual sensations, also sensations in the lobe of the left ear and organic sensations deep within the head,—all seem like strain toward the left; (the whole complex means attention to the buzzer)."

§11. (Refer to p. 359.) 'Attention away from' is not the same as mere absence of attention to; they differ as turning away from a thing differs from not turning to it. Here are further instances: "Organic sensations in the head (pressures) and less clear strains in the back of the neck and shoulders; (the complex of strains means pulling the head away from the tube, or bracing it against force from the tube; the strain sensations together with the organic carry the meaning, 'The odor is present')." Again, "Very strong organic sensations deep in the top of the head, as well as less strong muscular (?) sensations (due to disturbance of respiration) (mean effort not to attend to the odor)." Several times the attention is turned away from something indefinite: "A complex arose similar to that of tilting the head back (meaning attention from something)." (What was that something?) "It was indefinite." To this he adds, mentioning an emotion, "Organic sensations in the trunk, I think, meant fear of attention to." Sometimes in this connection he speaks of bewilderment.

§12. (Refer to Table V.) We need to explain how the fractions $\frac{1}{2}$ and $\frac{1}{4}$ come into this table. The former is due to our counting the judgment 'same' or 'equal' as equivalent to $\frac{1}{2}$ stronger, or $\frac{1}{2}$ fainter. Occasionally, however, the judgment given is 'equal or fainter' or 'equal or stronger.' In Series I and II I classified such cases as doubtful and repeated the test. But in fact when the observer says 'equal or fainter' he definitely means 'not stronger,' and is not in doubt of at least so much; therefore I counted this judgment as half way between equal and fainter, that is, $\frac{3}{4}$ fainter. The matter, I admit, is debatable; but whatever stand we take is not of much importance for our present work, since such judgments were unusual and our figures are therefore little affected by this way of counting.

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§13. (Refer to Table V.) After saying which odor was stronger the observers each time reported whether attention on the sound had been successful. In case of failure we repeated the test. Observer G was not asked to give such reports until the series was almost half over; but apart from this we made it a rule to obtain them. Where repetition is thus made the judgment in the second case may differ from the first. The figures in Table V represent the approved conditions, namely successful concentration on the sound, except for G as above noted. Our figures would have been virtually the same for G and E even if these repetitions had been omitted; but for B there is some difference: had we counted his first judgment in all cases regardless of whether attention on the sound had been good or bad, the figure for the 'Total Sum' of the second column would be 68 instead of $78\frac{1}{4}$. The repetition leading to improved concentration on the sound also leads to greater inhibition of the odor. Another set of figures for B, not included in the table, shows the same results.

WHY KANT IS PASSING

By G. STANLEY HALL.

For years I taught Kant, making him the focus to which all previous lines converged and from which all later ones diverged, and even devoted an whole year of seminary work to him. His historical importance will always remain very great. When the later systems declined, philosophy went back to Kant to re-form its lines. The Kant etymologists were exegetes of his very words. He was thought to have saved the world from the skepticism of Locke, Berkeley and Hume, and almost up to the present all thinkers must define their relations to him. But in the last two decades or so there has been a great change, even in his own land. A modern introspectionist, who holds that will is partly temperament, sits in his chair at Koenigsberg. The movement represented by *Logos* tones down his dogma to something very like literature. Some who have taught him with unction in the past have found him wanting and pronounced against him. Schurman just before laying down his professional duties, queried the value of it all, and James more than half thought the whole movement he represented a needless detour if not a grave mistake. Laboratory psychology owes him little but obfuscation, and not only introspection but the new logic and even epistemological lubrications, represented by men like Husserl, are finding out many most un-Kantian things. Fechner tried repeatedly, but was never able to understand Kant, and Hartmann called him "*der alte Confusions-rat*," the arch sophister of modern, if not of all times, the exposure and refutation of whom became almost the master purpose of his life. Years ago Trendelenburg and Kuno Fischer waged a violent, not to say vituperative warfare as to what he really meant by his *Ding-an-sich*, and Fichte's system was built upon what Kant protested was a cardinal misunderstanding of his meaning. All who differ are always charged by those who agree, with ignorance of him. With the twentieth century the Kant-cult has rapidly fallen off, even in the Fatherland.

Bergson, who owes so much to him, has practically abjured, Cohen is turning to other things, Avenarius is in the mid-stage of apostasy, and Vaihinger (in his very unique and almost inspiring German type of pragmatism),¹ has, although he paused twenty-five years after it was written before publishing it, given us one of the freshest and most inspiring of all departures from Kant and shown American and English pragmatism a new, if not a better way. Eucken long since began to drift from his Kantian moorings. Royce was too deeply enmeshed to do so but compensates by making delightful excursions into outlying realms. Münsterberg's Kantism is like a creed—a brief expression of basal youthful convictions in and sometimes very much out of season, injecting itself into his psychology. If the Kantian epistemology is, as it seems, the true *Heimat* of his soul, it matters less he is so much and often so far from home. Howison's Kant is uniquely infiltrated with Leibniz; while to the late W. T. Harris, Kant was never more than a minor prophet of Hegel. Garman used his Kantism in a masterly way, somewhat as Socrates did his dialectics, to convince youth of ignorance, to make them feel helpless and receptive so that they would follow the more docilely the way out that he had prepared for them. Six American realists, after various conferences, sought to formulate their creed in a way to minimize the long standing differences in the central Kantian field. Of their success each must judge for himself.² Russell, of England, agrees that relations are external; and this is the core of the new realism. Thus they, too, step out of the magic circle of Kantism. Even Cohen says (*Logik der reinen Erkenntnis*, Berlin, 1902), that, as more than thirty years ago he began the reconstruction of the Kantian system, he was astonished to find "that the understanding of its fundamental ideas had been lost, or rather had never been attained," that he believed that he must understand him better than he understood himself and that the sad issue of original philosophies since could be explained only by the fact that they had lost their orientation to Kant and "totally misunderstood his system, method and terminology." In what follows I have merely attempted to state curtly where and why it seems to me Kant is either wrong or of no further use for us, and to distinguish between what has become anachronistic and

¹ *Die Philosophie des Als Ob*, 1911, pp. 804.

² *J. of Philos., Psychol., and Sci. Methods*.

what has proven really germinal in his scheme of things, and in it all I am thinking not of experts, but of students.^a

I. A fundamental trait of Kant's philosophy is the postulation at the outset of the sensory or faculty of intuition which he describes in his transcendental aesthetics. It is an outer or fore-court of the mind through which all impressions from the external world enter. Sense objects are radically different in kind from those of the understanding and must be imagined or manipulated by an elaborate schematism before they can reach the four forms of ideas of the understanding, which is empty until they do so. The first criticism of Kant's Critique is that there is no such faculty as a sensory known to introspection, to pathology, to brain anatomy or to genetics. Neither subjective nor objective psychology today recognizes any such thing and it is a stumbling block in the way of all these disciplines, as much indeed a product of abstraction as any scholastic quiddity or phrenological faculty. The great authority in which its author's philosophy is still held makes this doctrine a formidable foreign body in psychology. Sensation, perception and understanding represent roughly the various degrees of appropriation of apperception, the whole process of which is too integral to be partitioned. The deliverances of each sense are often if not usually far more closely connected with the higher assimilative processes than they are with the data of other senses. Auditory, tactile and olfactory impressions may be understood each with no reference to the other. Even the old doctrine of common sensibles applies to but a few classes of sensations such as sight and touch or to abnormal fusions like cases of colored hearing, photisms and the rest. The senses are for the most part disparate and incommensurable, so that Kant's sensory is a product of the exigencies of his age and has nothing to correspond with it in the soul.

II. The geneticist however can never rest in refutation, but must always find a cause for every aberration from the truth. So here he must ask why the famous Königsberg postulator came to hypothecate such a thing as a sensory. The answer is because, like all epistemologists and idealists, he misprized time, space and matter as he also did sensation. Between Locke who accepted the senses as the only source of true knowledge on the one hand and on the other Berkeley's impeachment of their witness, Kant, like the true arbitrator he always strove to be, gave them the humble yet important

^a See also my paper on Berkeley, *A Genetic View of Berkeley's Religious Motivation*. *J. of Religious Psychology*, April, 1912, p. 137-162.

function of purveyors. They can tell us nothing of the ip-sissimal *Ding an sich*, but they are otherwise veracious. This is the only compromise position possible. The senses are feeders to the understanding and their certainty is sufficient and with that we must be pragmatically satisfied. All they say is true and the mind, a vacant *tabula rasa* before, now reveals previous, undiscernible potentialities. Yet back of all these processes there remains something noumenal, unknown and unknowable, the metaphysical soul of things that the senses cannot grasp or convey. Thus both Berkeleyans and Lockeans, both idealists and materialists, must make concessions and each must admit the partial truth of the other. This was indeed a masterly form of constructive diplomatic accommodation. As a treaty of peace between warring partisans, it showed consummate skill in the construction of its terms, but in drawing it up, current doctrines and not the actual facts of sense experience were considered. It was all dogma and there was no true psychological science about it. Moreover, it was all, artful and covert as it was, in the interests of idealism as was shown by Fichte, Kant's *enfant terrible*, who, by identifying the *Ding an sich* and the self, drew the inevitable logical consequence of absolute idealism. Kant, though no doubt secretly pleased, officially drew back from Fichte as dangerous to his scheme of harmony.

The pact between parties which created this monstrous thing called the sensory had also divorced what nature had made one and inseparable, viz., sense and intellect, and so widely that between them yawned a chasm which in the interest of a decent and common loyalty to the facts of mind had to be bridged. To do this, Kant constructed one of the most fantastical of all speculative creations, his *schemata*, made solely of time aspects, ignoring those of space, viz., the quantitative *series*, the qualitative *content*, the relational *order* and the modal *whole* of time. Through these, the *a priori* concepts of the understanding get their grist to grind. But no experimental or introspective study of the processes of perceiving and comprehending things ever found the filmiest trace of any part of these schemata. They are the pure inventions of this conciliator and concordat maker, now however seeking not to harmonize opposing parties, but to heal a scission or fission which the exigencies of his own previous arguments had caused him to make in the soul itself. Before he had sacrificed psychic facts to harmony. He was now patching together the edges of the gaping wound he himself had inflicted, for the normal soul shows no trace of

any surface of cleavage between sense and intellect, but only perfect continuity.

III. Again, neither time nor space is the proprium of the senses alone, of which only he makes them the categories. He drops space unceremoniously, and strangely and curiously enough takes time to the very gates of the understanding which however it too cannot pass, for according to him both belong to a lower order of psychic truth than do quality, quantity, relation and modality, although from Aristotle down to modern philosophy no one had ever before challenged the place of both these at the regal table of categories. In point of fact, the reign of time and space only begins in the sphere of sense and they constitute almost the master light of all our thinking, however logical and abstract it be. Moreover, it is space and not time that is paramount. The highest, clearest and surest thinking, even imageless thought itself, if such there be, can no more transcend time and space than the bird can outfly the air. Both are implicit in every psychic act. If we once break with these trusty guides, we are at the mercy of any fatuous speculator, for we are in the condition of one who cannot swim and is beyond his depth and clutches at any straw. To give them the supreme place in the lower realm of sense does not atone for banishing them from the lofty realm of innate ideas where they had always been—a realm where they do not but should reign, as Trendelenburg long ago showed, without motion or change or any other dynamic idea, *werden* or development. It is like transition from the warm, moist, vital, growing earth to the cold, arid, dead moon and moreover, no airship of speculation can ever really make such a trip. The true doctrine of the sensory relations that accords with modern psychology and neurology, brushes aside all this Kantian work of sejunction. There need be no gash, therefore no sewing up with clumsy stitches. Sensory processes in fact pervade the entire domain of the understanding. The recent studies of sense have helped us far more to understand understanding than have studies of the understanding helped to understand sense. Modern psychology has tended to give to sense the hegemony over understanding rather than conversely, à la Kant. Aschenbrödel has found in introspection her fairy prince. He has transformed her from drudge to queen, but she comes to her own kingdom with no malice toward even the cruel stepmother who so long degraded her.

IV. But the mesh of Schemata that make it so hard to pass from one to the other, or at least to understand how

impressions get into the mind themselves and are subsumed under the categories, is less intricate than if we take our stand within the mind and proceed downward toward the senses, for this way the maze is still harder to thrid. To apply synthetic judgments *a priori* to sense data, we must use *axioms of intuition* if they are extensive, and *anticipations of perception*, if they have degrees of intensity. That is, we must consider the permanent possibilities of sensation. There must be, third, *analogies of experience* so far as accidents, cause and effect, or reciprocity in time relations are concerned; and fourth, there must be *postulates of empirical thinking*, viz., possibility, actuality and necessity. These and only these judgments we can make, but we must always apply them to objects of possible experience and never to noumenal things beyond that we cannot experience, for the intellect cannot transcend sense because the idealist makes all knowledge only phenomenal.

Categories are the *summa genera* of thought. As the term implies, they were said to have been derived by Aristotle from listening to all topics of conversation in the marketplace, and to be thus products of induction, the highest generalizations from experience. If we took all the themes from encyclopedias, dictionaries, biographies, written and unwritten, etc., etc., and classified them into varieties, species, genera, orders, we should reach a few supreme intellectual radicals like, e.g., the 121 speech roots which Max Müller thought to be the ultimate sources of all words in Aryan languages. In point of fact, however, categories are not thus inferred, but they are assumed postulates and their validity depends upon their applicability. They are not conclusions of induction, but the most advantageous starting points of deduction. As Trendelenburg's classic treatment of their history shows, they are the prime determinants in all systems. Given his categories, you can infer most of a philosopher's scheme of things. They are supposed to shine by their own light like the sun and not by reflected light like the moon. They are the source of all our philosophic seeing. Save for the above dim peripatetic tradition, they have always been taken for granted, given not made, and Kant planks them down with no thought or query as to their pedigree or derivation, a duodecalogue, his twelve Tables of the Law for his *Verstand*. He never dreamed that though innate in the individual, they might be acquired by the race as Herbert Spencer said, nor that they hang together in one organic whole, a diamond network, as Hegel's logic sought to show. They stand forth in the Kantian scheme as

not only underived, but isolated from each other in the region that Locke thought void, and despite Occam's razor, or law of parsimony which taught that ultimates or essences should not be admitted save under the stress of dire necessity. The whole dozen of them (a sacred number by the way) make their *début* veiled and sunk in mystic slumber till awakened from their spell by the incantation of sense experience and then they assert themselves as lords of life and knowledge and at the same time as our interpreters and guides, and yet they are solely logical, noetic, static, without a dynamic principle among them all. Because they are above time and space, they are also above all such concepts as energy, activity, *actus et purus*, while evolution, change and movement have no place among them.

But in fact categories are abstractions and not entities, essences or enneads. They do not preexist in the mind as innate ideas. Their *esse* is *cogitari* as Berkeley said the *esse* of things is *percipi*. They have no existence in the nature of mind but even the best and truest of them are only permanent possibilities of thought. They are not only not metaphysical but not even metapsychological. They are not archetypes, but ectypes. They are psychological phenomena, not noumena. They say nothing and do nothing. They are only highly generalized names for groups of concrete experiences. They are the purely imaginary fetiches of the idolatrists. They are composite photographs of actual thought processes bundled up into classes. They are not even analogues of the generalized type forms of biology, like the *patrofelis*, father of all the cat tribe, with the general traits of all and the special traits of none of the species that spring from it. Each is only the *flatus vocis* designating the point where concrete empirical thinking in a given domain vanishes into the inane and conversely, the point of departure for a deductive logic that wants a major premise all connotation with no denotation. They are the ghosts of defunct things and thoughts reincarnated by clothing them with sarcous and experiential habiliments. They are little more than the logician's wishes embodied in definitions and that is why they are little less than sacrosanct to their creators. They are the scholastic entities accommodated to post-Lockean fashions just enough to enable them to pass the now relaxed *censur* of Locke's followers. In point of fact, they are probably not entirely imageless to introspection but they always tend to be hypos-tatized and made the most instead of, as they are, the least real of all the creations of human thought.

Again, about all the distinctions implied in the whole Kantian web of them are really made in extremely elementary sense experience. One and many, assent and dissent, reality and appearance, certainty and possibility;—all these are involved in a rhizopod's quest for food. An object is there or not there. It is big or little, truly or apparently there, and it must or may be there; however low in the scale these distinctions of quality, quantity, relation (and mode) respectively, they are not only implicit in elemental activities but perhaps as effective there as in the human domain. Thus, if time, space and objective reality, which Kant would relegate to the sensory, do in fact reach up through all the processes of understanding, so conversely his categories reach down to the sensory of even a rhizopod, to which therefore, we must give his *Verstand*. Very low forms distinguish one or two or more eggs or young, decide between acts or things as if by a rudimentary yes or no, are wary of the appearance of enemies and wise in detecting true and false signs of them and distinguish between the possible and the impossible, as all observations on the simpler forms of instinct and all controlled conditions for the study of trial and error processes abundantly show. These processes animals are performing all the time and perhaps they are no less prerogatives of the brute than of the human intellect. Thus, if a Kant of the animal mind were to arise and give it the honor of a critique, he would have to give it a table of categories, and the clumsy structure of Kant as it stands would perhaps fit them as well as it does man.

Thus limiting ourselves to Kant's very inadequate and antiquated table of categories, three out of four of his groups so factitiously trinalized, viz., those that deal with one and many, affirmation and negation, substance, attribute and cause, if not reciprocity, are objective distinctions which inhere primarily in nature, and only so far as these are apprehended, that is, only in a secondary and derived way, do they inhere in mind. To subjectivize them denatures them. They are independent of all and every intelligence, else science rings hollow and falsetto, for in it we are in fact studying real objects and not studying the mind. The mind is only a medium which has its defects as does the eye, but the interpretations of neither invalidate their objects. Things are things, as sound common sense and the *consensus omnium gentium* considers them and to assume that they are essentially other than we know them hamstring intelligence. The *Ding an sich* is not even an unknown, but a meaningless

abracadabra, a name for nothing either psychic or physical, a superstition of logic, a creaking of the thought machinery which vanishes when the psychic processes are oiled so as to work smoothly as they should do.

The *judgment* of formal logic, which deals with proposition and syllogism, gave Kant his categories. This was natural in a day when logic was the queen reigning supreme over the whole domain of knowledge, the discipline of disciplines, a complete grammar of thought; when psychology was only a menial handmaiden in the house of philosophy and science was rudimentary and dealt chiefly with non-living matter. His categorolatry is for us a pregnant reminder of the long past day of this enthronement of logic. He sought only to give it the same authority in philosophy that mathematics had for physics and astronomy (which then stood chiefly for science). It has always, from Plato to Spinoza, been the pet foible of speculators to postulate such an organon of sun-clear, primal, *a priori*, necessary truths, from which one could reason *de more geometrico*. But the very fact that no two deductors agree in axioms, methods or conclusions, ought to dispose of this inveterate fallacy. Mathematical categories have universal but speculative categories have attained only the minimum of consensus. Indeed, the muse of the kind of logic that inspired Kant's categories is now only a formal cult, her votaries are few and when and where her voice is at all heard it is in the thin and piping notes of age. His categories thus have no more real authority over the thought of our age than the canons of theoretical aesthetics have in the world of art or the old creeds and theological systems over the religious and moral life of our age. All these linger on in the protected and artificial conditions of academic life but only there. Categories are foreign bodies, interfering with real cultural efficiency. Instead of being organs of apprehension or modes of assimilating sense perception they are strange, nondescript, mongrel products, half platitudes and common places, half artifacts and surds. They cling like burrs well rubbed into the hair and beard in the minds of those indoctrinated but must be combed out, painful though the process be, if we make a good and modern intellectual toilet.

To know things through the media of time and space is, according to Kant, not to know them really and truly but to know them phenomenally and mathematics lives entirely in the realm of the transcendental aesthetics, i.e., in the sensory, for it deals only with time and space relations. In fact all

real things are in time and space but to Kant they are so *for us* and not for and in themselves, so that mathematics concerns itself only with their phenomena. Thus he twice degrades mathematics, once by relegating it to the sensory and again by limiting it to mere appearance. Never was mathematics put so low in a hierarchy of knowledges. But what are the judgments of quantity at least, to say nothing of those of quality, but mathematical, and of the elementary, arithmetical kind, and yet he puts them in the understanding. The later logic of Boole applied mathematics to the domain of quality, relation and mode in defiance of Kant. Affirmation and negation, limit, cause, reciprocity, infinity and possibility—all these now have their calculus and are measurable by this science which Kant makes a subaltern of the sensory. Moreover mathematics now proves that even axioms are not of *a priori* but of empirical origin. Thus, his carefully surveyed boundary between sense and intelligence is not only broken through at every point but is practically obliterated by modern psychology.

The simile of "spelling percepts to read them as experiences" has done perhaps even more than all Kant's arguments to give a certain verisimilitude to his bifurcated theory of noetic origins and processes. It shows Kant a persuasive rhetorician. But a glance shows the fallacy of the conception. Sense data are not late understood symbols but as we have seen, the oldest and truest sources of all that is psychic in the world. To make his simile true instead of like letters he might better have assumed percepts to be like primitive root words or sounds. Again, the child speaks and understands before it reads. True and living speech lies in the aboriginal ear-mouth tract, while reading long-circuits speech to the optical tract and substitutes the dead, artificial, printed page for social converse. In understanding its environment a child does not pick out analyzed sense data, as letters are analyzed phonic elements, and combine them by synthetic judgments *a priori*. By every natural method of teaching reading today he is taught to see the whole word-picture first, and is told its meaning by some one, for he never would have guessed it for himself. The implication that sense data are arbitrary signs like letters and that the epistemologist is the primary teacher of how to learn to read meaning into them is very dear to idealogues, almost as much so as the conception of Socrates that the philosopher is a midwife of ideas. In fact however several German states forbid spelling methods by law and most pedagogues condemn them as mind-

breaking and cruel, and the Kantian scheme is no less anti-natural and false to psychic facts and processes. This illustration therefore can have value only if we make the following preposterous assumption, viz., that the child can and does know language only by means of reading and not before, that it gets all its knowledge from the printed page and that letters themselves represent the elements and give the data of all cognition, somewhat like the chemical elements into which everything can be analyzed. In the letters to be spelled, if this simile of Kant's holds true, all possible knowledge must lie implicit, as the Talmudists thought.

Turning now to the Transcendental Dialectics, which deals with reason, which is factitiously partitioned off from the understanding by containing ideas instead of categories, which forms principles from the ideas instead of makes maxims from concepts, we find reason conceived as the faculty of the unconditioned although it depends upon the judgments of the understanding, somewhat as the understanding depends upon the sensory. Yet although transcendental in its nature and origin, reason must never become transcendent, that is, it must not apply the categories beyond experience or to the unconditioned, because to think is to condition, as Hamilton in his most Kantian chapter later argued. The first false magic lantern picture which reason has always loved to project is that there is a soul or thinking subject. The so-called rational psychology of Kant's day knew much about the soul and made it unitary, simple, undecomposable, outside of space if not out of time, immortal. All we can really get out of the Cartesian *cogito ergo sum* is that thinking is a real phenomenon. But from this to infer to an ego or object to which categories can be applied is a paralogism or subreption and may lead to the delusion of conceiving the soul-self as either matter or spirit according to diathesis or preconception. Why if categories are transexperiential or transcendental in their origin, may they not, for aught we know, be also applied transcendently or beyond experience? Speculators had, indeed, almost universally assumed that these mystic, authoritative categories, strangers of alien origin, may tell us of things beyond the ken of experience, thus correlating their origin and range of application. Psychoanalysis also suggests that they have been so cherished chiefly because they have some oracular and revelatory power of this kind. If, for example, they originated in race-experience, why not apply them as keys to it? Kant, however, denied the transcendental application and should he not also have

denied transcendental origin? Had he acknowledged that they were empirical, as in fact they are, at least phyletically in their origin, he would have had a better warrant to confine them to experience. Why a transcendental origin and no transcendent field? This seems an anomaly in the critical philosophy. The answer is that Kant was even more pragmatist than he knew and even here wiser in practical application than, in his pre-evolutionary days, he could perhaps be expected to be in explaining origins. He saw aright when it came to the uses of categories but followed the easy, traditional way of assuming them underived, as Moses brought down the Tables of the Law. Postulation and hypothecation for him play a rôle not unlike that of myth for Plato. Both were tentative formulae or frescoes on the wall of nescience where knowledge stopped. They were to be accepted by faith, at least pending the advent of knowledge. With his strong evolutionistic tendencies it is almost certain that, had he lived in our day, he would never have insisted upon the transcendentality of the categories, for idealist though he was by temperament and sympathy, he would have shrunk back in anticipation of the transcending use of the categories that became the chief feature of the system of his successors, Fichte and Hegel, who were encouraged to use them thus by his ascribing to them a transcendental origin. To have shown that pure reason can never prove the existence of the soul as a substantial entity, that reason can never reach the *Ding an sich* but can only study its phenomena, quaint as the logical method was by which he arrived at this result, was a master-stroke. But it is almost like Canute sweeping back the tide to evict the bias of hopes and fears regarding a future life that since Kant, almost as much as before him, has both shaped and motivated so much of so-called scientific psychology. The lust to know whether if a man die he shall live again, which Myers says is the supreme problem of all the ages, still weights all the dice and makes us lynx-eyed for every favorable and bat-eyed to every contradictory intimation. It was reserved for the invalid, under-vitalized and academically isolated Kant, who almost immolated himself to his theme and who knew the world he lived in so extensively but only through the dim, second-hand and bloodless medium of books, to waive his own personality enough to make the great renunciation of evicting at least from his cold weird logical reason this all-pervading lust so to construe the soul that it should be made of something which should be at least immortal enough not to be blown away or dissolved

into the elements when "the tides that draw us from the boundless deep turn again home." A less anaemic or frigid nature would hardly muster the virtue to see or the courage to proclaim a soulless psychology. Arguments in general, especially such weird, old logical gearing as his, only give pretexts for believing what one will. We have additional and better ones now for the same agnosticism concerning the soul's entity or substrate and must bravely accept the phenomenality of our psychology in the sense that botany and zoology accept their science without a biologist or spirit of life, that physiology dispenses with its old vital principle, and physics accepts matter without being able to define it or energy.

As to the cosmological idea, pure reason can make, we are told, no statements regarding the universe as a whole because for every thesis there is an antithesis that can be no less cogently proven and hence arise the antinomies. Quantitatively we may say the world began in time and has limits in space or conversely that it was eternal and is infinite in extent. Qualitatively we may affirm or deny that everything is compounded of ultimate, simple parts, or that we can never get to absolute simplicity and atoms and even ions may themselves be indefinitely compounded, i.e., matter may be infinitely divisible or there may be a perfect continuum back of all as C. M. Pierce says. Relationally this may be called a world of law and necessity, where causation reigns supreme, or we may postulate freedom which may be itself a true cause. Modally we may urge that all came from something or some being that is absolutely necessary, or again that there is no fate and all is contingent. These four dialectic contradictions Kant uses to show how agnostic man is doomed to be concerning the great autos, Nature, whose Memnonian lips will never open to give answer to any of these questions, however agonizingly and desperately we may shout them into the great inane. We can never penetrate the veil or reach the soul of Nature or even know whether she has any, nor find out what she means by all her phenomena or processes. Science may peer and query but can only answer her own questions by others more subtle. However vast the area of knowledge grows, it is itself still surrounded on all sides by a limiting surface of ignorance which can never be passed. A true philosophy and still more a true metaphysics of nature is thus forever impossible. How epistemologists since have loved to shake this old Gorgon's head in the face of science and tell her what she can do and know and what not with-

out committing the unpardonable sin of "transcending!" On the other hand, how enormously our ideas of the extent of the universe have grown, how it has swelled in time and space to dimensions big enough to be practically infinity, although there is always a beyond for every new frontier, no matter how far it is advanced! Hence, who cares for the difference between astronomical and mathematical space or time, or indeed for anything meta-mathematical or meta-astronomical? We need never feel claustrophobic or shut-in symptoms. So as to divisibility, the thousand ions in an atom of hydrogen are small enough. What difference can it make save for the mania of a paranoiac logic-chopper whether there are indefinitely smaller bodies?

As to the antithesis between causation and freedom, where Kant would non-suit or outlaw both contestants, we are taken into the very different domain of the relation between the cosmos and the human or moral order of things. Here we must continue to investigate and discuss despite Kant's *caveat*. Both contestants have their rights and the practicalities involved are many and great. He might with precisely the same justification taboo the problem of objectivity *versus* subjectivity for the one is just as insistent and yet as insoluble as the other. In fact, Kant himself later in the "Practical Reason" takes his stand unreservedly upon the side of freedom as against law, in violation of his own prescription, and here again he is pragmatic. Partisans who desire to assert either to the entire exclusion of the other are now few if any. Both can be vindicated and each has an ever widening domain and ever stronger case. The whip-row here is not within the cosmological realm but it is between that and the moral order or between Kant's pure and practical reason. These are as incommensurate at least as color and form, if not as vibrations felt by the hand and those felt by the fibres of Corti's arches in the cochlea. The third antinomy is thus a commonplace with no agnostic implication whatever save to those who would cast themselves into the camp of the ultra-materialists or spiritualists. These thinkers constitute a now happily extinct genus. A fresh bumper, then, to the great little apostle of pure reason, the peruked precisian and fence-viewer! Or, more temperately, a fresh sprig of bay on his tomb in bleak, far-off Königsberg, for his help in hastening their extermination, for they are unfit to survive under the conditions of either present-day science or philosophy!

As to the fourth antinomy, whether the world has a necessary first cause or had to be at all, or is a product of chance,

either view can be maintained. Only theologians know or care whether God had to create the world or did it out of caprice, good will or malevolence. From Spinoza who said substance might have had an indefinite number of other attributes than the two it had, viz., thought and extension; and from Malebranche, who revived the old creed that creation is constant preservation, that God is creating the universe every instant and that he intervenes on every occasion when mind and body co-act, to von Hartmann who said the worlds and stars are pimples in a rash with which the divine Absolute Being broke out, and serve to mitigate his transcendent pain or negative eudaemonism, and to those fatalists and materialists who say that from the nebulae to man all the great processional everywhere had to be just as it is and there is at no point any possibility of miracle or of accident:—in the whole genus of ratiocinations of which these are specimens, we never can make the slightest addition to actual knowledge. If Kant only meant to rank all such speculative dreams as the poetry and romance of philosophizing, he did a service. He was in fact an evolutionist so far as the origin of the worlds from nebulae is concerned and doubtless believed in the reign of law over all these processes and if so, all the greater was the virtue of his proclamation of neutrality here and his call to the factionists to lay down arms, or be sentenced to *Banausia*.

Lastly, as to God. It was easy to puncture the old Anselmic ontological argument from the conception of an absolute or perfect being to his predication, for we cannot infer from idea to the existence of the object of that idea. *Is* is only a copula and does not assert existence. Conception only involves possibility and not actual reality. If every man who ever lived believed in a God, that would be no proof that he existed, nor if all wanted and felt the need of one, would it argue existence any more than the conception of a fortune or the wish therefor would bring it. We cannot argue from notions to the existence of their objects, for culture history shows that most things that have been universally believed are now known to be non-existent. Again, from the existence of the world or of my own and all other selves, we cannot argue that there is or must have been a most real and necessary cause as real or more so than its effects. We have seen that all might arise from chance and if we require a cause, that would not necessarily involve a God, but force and matter might suffice. Third, the teleological argument for God, or the proof from design or with physico- or natural

teleology, venerable as it is, can at its very best only give us a manipulator of material already created. This contented Kant. But we could now add that the old concept of design which has always been the most bitter and inveterate foe of evolution throughout all history, is now hopelessly and forever shattered by it.

Thus, in fine, reason can never prove the existence of God, still less his function as creator or planner of the world. The idea of such a being is not constitutive but merely regulative and formal. The God-idea may be and perhaps is in itself the summit and crown of human thought, its greatest achievement in fact, but the existence of any objective being corresponding to this idea can never be either proven or disproven. All the certainty there seems to be or is concerning the existence of God or soul or a cosmic order, i.e., whether this is a uni- or a multi-verse, as in Hafid's dream, is solely subjective and we must get on with that and find it sufficient.

With this, Kant's first critique ends. If the field so far surveyed had represented the whole of the soul of man or if Kant had died at this point, he would have been known as the most extreme of all agnostics. Time, space and mathematics are for the first time degraded to the sphere of sense and thus made not only subjective forms, but subalterns. We can never attain true knowledge of anything in their domain and yet this domain we never can transcend. What we have called matter is made up of various congeries of phenomena and appearances and there is nothing more tangible than the ghostly *Ding an sich* back of it all, so that the world is essentially hollow and unreal. Intelligence can only work upon sense data and concerning the nature or existence of soul, natural science or God, we can never know. Never was there such a thorough housecleaning of man's soul. Never were substance and everything metaphysical so cheapened and almost vanquished together with their time and space receptacle. The latter even Berkeley, who subjectified matter, clung to, but psychology as then understood, cosmology and theology (which Berkeley particularly held a brief for) were themselves by Kant cast into the void of phenomenalism he had created. "The rich old world lay shattered and ruined at Kant's feet" (Vaihinger) and pessimism seemed the imminent if not inevitable sequel, for Kant had out-Berkeleyed Berkeley, while in his negative treatment of cause and the ego, he had out-Humed Hume. He accepted all that Locke had said, viz., that the senses are the source of all mental content but cheapened their data, outraged him by equipping

the mind very richly with innate ideas to such numbers and in such a way that the subject is all and the object nothing.⁴ Prodigious as were the powers he gave to the soul in the categories, he shut it away from everything whatever except empirical data themselves essentially unreal. Hence it was no wonder but rather inevitable that his great successors, especially Schelling, Fichte and Hegel broke the walls and let the giant of their Romantic Philosophy loose upon the forbidden grail quest for the transcendental. This is the point in Kant's system where, during his own life and since, earnest truth-loving students have committed suicide because Kant seemed to have robbed them of all that was worth living for—Truth, the Soul, God and Heaven.

Until we reach the transcendent dialectics treating soul, world and God, the Kantian Critique has now little value or interest to students of mind, save a historical one. Yet strange to say, it is just this part that has had chief attention for more than a century since its appearance (1787), while his Critique of the Practical Reason in which his merit culminated was only superficially discussed or apprehended till in our day the Pragmatists have dug up its meaning, fragment by fragment with, however, very scant acknowledgments to the author because they lacked historical sense or knowledge enough of it and its implications to realize that everything they have said or more lies patent or latent in it. In modern Pragmatism, the true Kant has been resurrected; indeed has been for the first time really discerned. It is not creditable to the state of the history of philosophy or to the true knowledge of Kant by English or even German writers and readers of Pragmatism that they stare blankly and even show incredulity when told that it was all in Kant and more and that they have really only begun to exhume his remains, unwinding his cerements or combing out his coiffure as the peignoured Brobdignagians did those of the great Gulliver. At least, to change the trope, they are only shoveling out

⁴ Heine satirized the situation somewhat as follows: The day Kant finished his lectures on the Critique of Pure Reason, his old servant, Lampe, came for him, and as the weather was very bad as usual in far off semi-boreal regions, put on his overcoat, muffler and galoshes, and took him carefully home, holding an umbrella over him, etc. As they went, Kant reflected to himself: "I have executed God, as the French did their Louis, and the English their Charles I, but it is really too bad to rob such a poor creature as Lampe of his God. Even a dog needs a master to look up to as his God." So the great, little philosopher went home and wrote his Critique of the Practical Reason for the poor in spirit.

the soil he loosened. Beyond all comparison the greatest and truest thing Kant told the world was that the will is larger and deeper than the intellect. With him it first began to come to its rights, as the feelings did with Jacobi and Schleiermacher, all of which modern psychology confirms and reaffirms. Kant thus set up a new and higher criterion of truth far above that of the old logic. A new king was proclaimed in philosopherdom whose dominion is to extend even over the whole Philistia of intellect as well. Ethics was seated on the old throne of ratiocination. Conduct is above even noetics. The Kantian epistemology had been so belabored, commented on and its very verbiage so tortured like Sacred Writ by exegetes, although the Critique was written down hastily in a few months with chief attention to its content rather than to its form, that only today have we really begun to read and understand this second and greater Critique in a way that will show, when we see it all in its true perspective, that our Pragmatism is so far only a faint revival of Kant, for all the insolvencies of pure reason were cashed in with interest by the new firm of Conscience and Co. Doing is now the true organ of knowing. Do your duty and you shall know the true truth, was his proclamation. Wisdom is justified by acts and deeds and not by categories, still less by dogma.

The procedure of this new instauration is clear and simple. We must first turn right about face, or invert ourselves as Dante had to do at the lowest hell, at the earth's center of gravity, to be shot out at the other side of it at the foot of the purgatorial mountain. The problem is now no longer how can the pure reason know objects *a priori*, but how can the practical reason determine will *a priori*. We care no more for the cognizability of objects, but only to direct volition or creation aright. We start from moral principles, not from sense intuitions.

The philosophy of conduct thus begins with the freedom of the will, the very existence of which *pure* reason could not prove without meeting the reverse or opposite argument of the antinomy. We have an immediate and ineluctable sense that we could have done otherwise, could do or even think this or that, and these amphibolies are always present. This is the first regulative principle, the constitutive value of which is here subordinate or rather entirely irrelevant. Freedom is the prime fact of man's moral experience. It is immanent in our selves, positive and not transcendent. Here a critique must show its relations to the sensory through the impulses

and inclinations in which it works for these are the sense motives of the empiric instead of the pure will. Now, this empirical will is transcendent and the intelligible is immanent, reversing these relations as they stood in the first critique. The law-giving will must determine itself in, for and by itself, purely and autonomously. Here then we have a new category, the imperative "Thou oughtest." This gives the supreme momentum and sanction of conduct. The lowest momentum from the empirical will is of a different nature, is heteronomous or imposed from without as an alien foreign determinant made up of the desire of pleasure and dread of pain. The former law of oughtness in freedom is universal, constant and necessary, but the algedonic or natural motives are fluctuating and moreover they can never be formulated as binding upon all men in all times and under all conditions. They can only be codified and utilized as maxims. They alone have given content to the will as the sensory does to the understanding. Hence, we must first put them in their most generalized form. When we do so, we attain the precept, "Act so that the principles that determine your act might be universal," so that for all with this rule of conduct there would be no contradiction and least harm and greatest good would be done to the greatest number. Thus utilitarianism is everywhere present, but everywhere subordinate to the higher autonomous oughtness. Hedonism and meliorism are in the inner court of the temple, but not in the sacred adytum itself where the oracle speaks.

What is the impulsion to act purely from within regardless of pleasure and pain? To this question Kant answers, we think wrongly, by introducing a noetic element. We know and revere immediately the moral law which reveals itself within. The awe thus inspired which strikes down self conceit and on the instant subordinates us to its behest is not a sensuous feeling, nor is it pathological or tainted by fear or hope, but it is an "intellectual feeling" of a unique kind, something *sui generis* and unlike everything else in the soul. We feel towards the moral law within the same devoutness that we feel toward the starry heavens without (the legend on his tombstone). The pain of subordination and coercion is exactly balanced by the pleasure of exaltation and expansion. Reverence is thus out of and above the domain of inclination or even love or, on the other hand, disgust or aversion. This rigorism does not imply that a duty can be done only against resistance or against natural inclination.

Here are implications that modern psychology, which in-

cludes ethics, cannot follow, even with the best will to do so. First, instead of a categorical imperative which incites to duty in general, with no intimation of any specific duty, psychology places the simple *nisus* or push up of evolution which says "Excelsior," and impels all to make the most and best of themselves. This is no less venerable or cogent, for it has behind it all the momenta of the whole evolutionary process. It is the *vis a tergo* that impels man ever onward and upward. It is the center of the current of the whole stream of tendencies that has made man man, that flows in the world today and strives to bring in the kingdom of the superman. It dominates and determines all our acts, but especially those we call moral.

Secondly, it is not the Stoic or Puritan conscience alone with its stern demands, with its pleasure-fearing, pain-despising implications and attributes, but it is the Greek chivalric honor as well which impels always to the highest ideal in conduct with loyalty to the race and to the unborn. Though of pagan origin, honor is more genial and humanistic, but it and duty always need each other to impel to the highest good.

Third, the supreme inner oracle of righteousness not only impels but it deters, like Socrates' daimon or the ten commandments. It has a negative which is quite as great as its positive or affirmatory function. A sense of worthiness and unworth, of merit and demerit always go together. The eternal nay is not in the vocabulary of Kant's categorical imperative, although the instinct what not to do is one of the most precious acquisitions in the whole struggle for survival. Do nothing unbecoming the *Übermensch* burgeoning in all of us, nothing against life, health, or virtue. That is, the ideal of the best men and women we might be takes the place of the men and women we are. This is the slogan of the modern evolutionary categorical imperative. This, too, may defy all inclination and demand even the immolation of the self in the interests of the race. Supreme self-sacrifice may be imperative. But even in such extremity, if we are hated, beggared, despised, tortured, we shall have the sublime satisfaction of the *mens conscia sibi recti*. A little of this pleasure once only in a lifetime may outweigh lower and life-long pleasure, as John Stuart Mill said, who would follow his inmost conviction of what was right and good "and if God wishes to send me to hell for this, to hell will I gladly go" and be happy there although he defied the Almighty, like Prometheus chained to the rock for his fire-bringing service to man. Of such metal the highest heroism is made. But

even such supreme self-sacrifice is not without consolation. Hence Kant is wrong. Man may rise far above the always selfish hope of heaven and dread of hell, but the fulfilment of his destiny always brings inner approval and he can almost hear this monitor say, "Well done." Hence Kant's attempt to rise to superalgedonic regions was a Pegasus flight which is impossible in the world of moral experience and which even the theories of intuitive morals do not need. All that is necessary is to distinguish the motivation of the race from that of the self, phyletic from ontogenetic ethics, for Kant's categorical imperative must and can only today be interpreted as the still, small voice of the race whispering amid all the louder voices of the ego. It says, "Thou oughtest" but to this adds thou oughtest first, last and always, to serve the race, whatever betides thee. Now this brings a unique but entirely supersensuous and superegoistic happiness that is ecstatic and intoxicating. It is the voice in the soul of the power that makes for righteousness.

But next and fortunately, the interests of the individual and the race usually coincide and rarely require the immolation of the former. Most of the deeper and stronger impulses are race-revering and most that really develops the individual and widens his pleasure field helps humanity. Antinomy and heteronomy are by no means always or indeed very often in conflict and so do not need Kant's belabored analytic to connect them. Indeed their harmony amounts almost to identity. We think we act for ourselves when we really are acting for the race. The only misfit modern psychology finds here is that between the also usually coinciding yet sometimes opposed individuation and genesis of Herbert Spencer. Taking our stand upon this instead of the Kantian principle, "Act so that thy maxims will be sound if universally acted on," we now say, "Develop your individuality to the highest point compatible with the most effective increase and transmission of life; be and do all you can to attain the optimum of parenthood." All less than this is defect and all beyond is excess, and on both the gods of generation pour wrath although from different vials. Some may be called upon to hyper-individualize themselves *ad maiorem gloriam hominum* or even to offer up their lives, experiencing "all the joy that lies in a full self-sacrifice." These heroes who offer themselves up to the phylum have their own rich meed of honor. But the test of all the ultra-genetic virtues as indeed the ultimate measure of value of home, school, state, church, and all institutions, is service to those who live and

to the unborn who shall spring from our loins. They are all to help us to bear and rear most and best children. This is the sanction of biological as distinct from what we may, borrowing a Kantian phrase, call transcendental morality. Thus virtue has two registers or levels as he taught, although they must now be very differently conceived. The antithesis is not between the sensuously impelled and the free will as he taught, nor between Huxley's cosmic and human order, but between the interests of the individual and those of the race and here we do not have a real bifurcation wherever these do not coincide but collide at whatever angle. The truest tragedy today deals with this struggle and no longer with the collision of two opposed virtues as in the case of Jephthah's daughter, or Iphigenia or other Greek drama motives. Nor do we need the casuistry of the Catholic church where cardinal virtues conflict with each other or especially with those lower in the hierarchy of them, so arranged that the lesser shall give way to the virtue of higher grade. The practical antinomy today is between what is good for the person and what is good for humanity. Into this all other moral amphibolies can be resolved.

Again, the impulsion to follow supreme oughtness is not an apprehension of the moral law in itself by a unique faculty of apperception directed to it alone as Kant taught, nor is it a religious feeling of absolute dependence, as Schleiermacher believed, but a no less unique but different feeling *of kind* or as I would call it in default of a better name, a *sensus numinis hominum*, more impulsive than discursive, more unconscious than conscious, a sense of direction or orientation not as to the individual alone but as to the direction in which the race is going. I admit this is as much beyond the present ken of psychology as are gravity tropisms, which distinguish so subtly and inerrantly between up and down. It is a compass which is not deflected (as it so easily may be) but points steadily toward the unknown pole of ultimate human destiny. Conscience, honor, moral sense and even ethical taste are only partial names for it. It says "Live for the race," and it warns or deters as well as impels. It is the soul of the overman in us, not yet born but striving toward birth through all ages and generations *in saecula saeculorum*, the millennial ideal man of the future of whom all moral struggles are the birth throes, with some phases of which we are occupied in every ethical endeavor and of which the moral history of the race is the slowly progressive nativity.

It is an instinct, impulse, *Trieb*, *nisus* or push up that even

genetic still more any other type of psychology, can not yet name or define. It is not first seen cognitively and assented to, but felt and acted on. It is an *ethos* rather than a *logos*, more *nomos* than the *muthos* in which it is bodied forth. In most acts and throughout most lives, it never comes to consciousness at all. It is more norm than form, from which the sum of consciousness measures the sum of error or departure either actual, conceivable or threatening. Shall we call it the goal of the human species so far as it animates the individual and the sense of direction that pervades the whole journey of life? What is its relation to Providence and is it infallible if heard aright? No one beholds a moral law written within and adores it as astrologists did the starry heavens any more than the bee makes its cell or the spider its web by geometry with appreciation of its meaning. It would take an intelligence as much above ours as ours is above the bee to understand this moral motivation in us as well as we understand that of the bee. Even the greatest specific acts of virtue and heroism are usually done, as von Hartmann says instinct does, viz., "according to a purpose but always unconscious of it." It is a sense of economizing life so as to make and get the most and best possible out of it, as opposed to the prodigal and spendthrift, who squander life on selfish and transient ends. It is thus essentially thumic and not epistemic, these two being somewhat related in the psyche as the spermatic and the somatic in biology. It might clumsily be dubbed an auto-phyleto-philic principle (sense for and love of racial uprightness), but this adjective only designates an essential attribute and not the ipsissimal nature of the impulse.

The moral impulse needs no such analytic or dialectic as Kant subjects it to, because its bottom motif is not *gnosis* but *thumos*, disposition or *Anlage*. The intellect is largely an individual product. Indeed, the intellectual element may interfere with moral practice, knowing with doing. The deliberative element is secondary. In fact, the noetic element is always and by its very nature heteronomous. It involves an object, and objectivization is always heterization, while only autonomy is purely subjective. Virtue impelled by knowledge may be very lofty and almost inspired and actually inspiring but it is always in a second and lower class in the order of moral nobility.

Again, how can freedom, Kant's basal principle, be the foundation of an imperative and that a categorical one, the opposite of freedom? The answer is that this freedom is not

a balance of choice between two or more alternatives but an impulsion that is or ought to be irresistible which nothing in the soul can oppose to keep to the one and only straight and narrow way. It is more like the *non posse peccare* than it is like the *posse non peccare*. It is more essentially impeccable than infallible. We act more wisely than we know and before. We tell why we so acted, if we do so at all, only later and very imperfectly. The virtue that thrills an admiring world springs like the greatest works of art straight up out of the dark abysmal regions of the soul. It is inspirational—from the heart and not the head. We stand in awe and marvel at the native, creative originality in the human soul, for every great moral deed thus impelled is a new thing in the world, a contribution to its moral growth. It is a gift and comes without research or even circumspection. It is new-born out of the great unknown within, beneath and over us. It is thus related to custom (*Sitten*) or morals, a little as the latter is to legalism or codified ethics, the former being one and the latter two removes from it on the scale that measures the grades of implicitness and explicitness.

What is the relation between virtue and happiness as the world knows happiness, i. e., pleasure? As Kant said, the Stoics were partly right, conceiving happiness as the consciousness of virtue, *but* there are pleasures that are not virtues. Also the Epicureans were partly right in conceiving the highest happiness as virtue, *but* much virtue in this world brings pain. The old Hebrew idea was that in a well-ordered moral world righteousness went with pleasure and prosperity meant right doing so that in adversity they examined their consciences, which were thus inflamed. In fact, happiness and virtue do belong together and their union is the *summum bonum*. Now, says Kant, pleasure and virtue do and can never completely unite in this world and so we must postulate a postmortem life in which they are forever one and inseparable. Now this is surely a *tour de force*. On this basis, if the world should ever grow so perfect that the good were happy here and the bad miserable, there would be no longer any need of or argument for immortality to bring them together and a millenium or golden age of this sort, if it ever came, would dispense with a future life for the consummation would be attained here, and to say that they must be united in each person through all eternity is going farther than the argument warrants. Or again, virtue and happiness might be completely united in a posthumous life for a time. Then the consummation would be reached

and life might go out so that we should be sentenced to the reward of heaven for a limited period. But again, is it a psychological fact that all men everywhere do believe that virtue and happiness belong together? Much has been deemed virtue that we now deem vice and there is quite a domain where one man's happiness is another's pain. Moreover, pessimists deny all such relation. To them misery goes with virtue and only optimists are firm in this marriage. Again, some Stoics and Kant himself felt that happiness corrupted virtue.

Once more, Kant's argument only attempts to prove a heaven where a reward is attached to goodness. But does not the instinctive sense of justice exactly as much affirm that sin and woe belong together? Is not this indeed a part of the psychosis that unites goodness and joy so that the belief is incomplete and falters without the former? If so Kant should by the same token have postulated hell as a place of eternal torment.

God, too, he postulates as a necessary being, the cause of both the natural and the moral world, who implanted in us the idea of the union of virtue and happiness and imparts the latter according to these traits of our mind. But who put sin and woe together, as they surely just as much belong, which indeed is only the obverse side of the same fact? Did God do this, or must we not exactly as well postulate a devil to tie these two up by a no less indissoluble bond?²⁸ Kant did not say and so his story of the practical reason lacks the

²⁸ God and the devil are sometimes conceived a little as running mates or sparring partners, or as twins, but as opposites, chiefs of kingdoms that divide the world between them. These two personages, together with their respective domains, Heaven and Hell, not only bring out each other by contrast, but have so long gone together historically that if one fades the other tends also to do so. To drop the devil tends to a twilight of faith in God. The doom of one foreshadows that of the other, as the dead moon is the death's head, or *memento mori* to earth of its eventual fate; and all devils are deposed, or ex-gods, as dead planets once lived. All this and more, we see if we psycho-analyze Milton's magnificent Satan. Ought we not to rehabilitate and reinstall the Devil? As Beelzebub, he was god of flies, *i. e.*, of bacteria. In the middle ages the *advocatus diaboli* was leader of the opposition, representing the minority. It was felt that God must not have it too easily, all his own way with no conflict, lest he degenerate, or lose virile quality. The Devil had much to do in conserving the theater, dancing, sports, etc., through a time when the church would have annihilated them. Of these the Devil long kept a sprouting garden or nursery against the time of need. As innocent pleasures cease to be forbidden the Devil's kingdom wanes. This the French diabolists strive to buttress up.

tragic side, vital alike for Christianity and for evolution. Or do the bad just die like beasts and is another life attainable only by the good? Nor are we wandering here from the standpoint of the practical to that of the pure reason for punishments are just as practical in the ethical domain as rewards.

So, too, Kant urges that we can know nothing of God whatever except that he is a power that in us inspires the idea that goodness and happiness belong together and later unites them in heaven. To attempt to know more, to know Him as creator, as preserver, as providence, or even as a person, to define any of his relations to time or space, would be to apply the categories magic-lantern-wise or transcendently, the *summum malum* of the pure reason. Hebrew prophets and later theologians went far beyond all warrant in giving God other attributes. If virtue and happiness do not both belong and get together there is nothing in the universe to which we have any warrant to apply the word God, for in the Dialectics Kant had shown the fallacy of all such grounds of belief in him. All scepticism of this junction, *arete-hedone*, involves atheism. No Kantian can accept a future life without a God for these two are for him organic unities. Yet there have been those who urged that there might be a next world and a very excellent one, without any Overlord but just a republic or possibly a social democracy, as they have deemed any and every conception of a God a not indispensable hypothesis for this world.

What, then must the modern psychologist of religion and morals conclude concerning these last two postulates? It is, in sum, that they constitute a sophistical construction that falls of its own weight and has very little warrant in the nature of the soul. Comparative religion knows it not for there are great religions embracing a large part of the human race, like Confucianism, Brahmanism, Buddhism, that know or care nothing of God or heaven. Modern ethical culture, although going back to Kant, has no use for God or heaven and holds that hope of the latter corrupts ethical motives. Moreover, the recent studies of the religious and more specifically of the Christian consciousness tend to incline us to regard both God and heaven more and more as immanent and subjective. Both are a state of mind. Again, if virtue and happiness ought to join and do not here, but do so after death, it seems that this world was so badly made that it had to be supplemented by a revised and sublimated edition to the correction of the fiasco this world has proven to be. Once

more, the categorical imperative gets on without pleasure and pain, is above and uncontaminated by them. The supreme ethical impulsion so needs to be disinfected of pleasure and pain that we can never be entirely sure that we are acting from the purest ethical motive unless duty is at least a little painful. Thus, virtue only becomes completely sure of itself when it sees itself in its nascent state if but for an instant apart from those elements with which it has closest affinity. Yet immortality and heaven exist only to alloy or maculate pure duty with the baser element of happiness and to make the right pleasure-toned. Thus a pure dutyist would scorn immortality and heaven as heteronomous. To accept salvation would taint or pollute his conscience or pervert it from the love of right for its own sake to love of the pay for well-doing, while God instead of being an all-pervasive power within the soul of man and of the world is known solely as the deviser of a scheme of postmortem revision of accounts which makes up for defects in the shining yellow metal of pleasure that is just adequate though it is deferred to a sequel or appendix life, all of which is done to even up misfits in the present life. The Kantian heaven is thus on an inferior and epicurean plane. God is knowable only as a re-pairer of a moral world that was illy made at first and he mended and tinkered the job which its unknown author had botched, by patching it with material of inferior quality. Thus in fine, the only truth in Kant's God-heaven construction is that these postulates have and will long continue to work well as a system of transcendental rewards (and punishments) to supplement the defects of the sublunary system. Righteousness is always the best policy if we take into account both lives, this one and the next. We can afford to suffer here if only it is usuriously made up hereafter.

On passing from the Critique of the Practical Reason (as he scholastically and epistemologically called the moral nature) to Religion Within the Bounds of Pure Reason, Kant takes still another standpoint and reaches conclusions which it is impossible to reconcile with either of the first two Critiques. Religion, we are told, is founded on morality, not conversely, because fear and hope would corrupt. Morality must lead to religion because the *summum bonum* is a necessary ideal of reason to be realized only through the God-idea. Religion must never first incite to virtue and God and heaven must never be moral motives. Still we have to recognize duty as a divine command and this indeed is the essence of religion which seems *revealed* if our duty at first appears to

us in the form of a divine command, and *natural* if we first find our duty and then postulate it afterwards as a divine command. The church is purely a community of those who would oppose evil and advance good in the world. It is visible so far as it is actually wrought out or attainable, and invisible so far as it stands for an unrealized ideal. The true invisible church must be, quantitatively, universal; qualitatively, pure of superstition, fanaticism and sin; relationally, free, a voluntary state; and modally, unchanging. All must rest on the moral faith of reason, for striving for virtue is all God or the church commands. But human nature is weak and so we must add statutory and historical parts which should be merely the vehicles of moral meaning and are without any validity independently of this. Every dogma, e.g., the Trinity, without moral content is worthless. Moral reason alone can interpret Scripture and whatever of it has no moral significance must be dropped. Of themselves, sacred records are of no more value than myth. The ideal is for the moral faith to slough off all the useless statutory and historical elements. Thus the kingdom of God is approached and when it is reached history will cease. (Thus far Kant.)¹

Against all this, liberal modern ethical theory has nothing to object except this: Kant assumes throughout that the moral faith can make assay of all creeds, ecclesiastical regulations, bibles, church history, etc., and can do so now or at a fixed time or more specifically, that some man or class of men, e.g., philosophers or moralists can do so. This is and will probably remain impossible. When any system allows elements thought for ages to be morally vital to lapse from its consciousness, there is always grave danger, because the folk-soul is so immeasurably larger than individuals, however cultured and gifted or however large a school of men is represented. In fact, all doctrines and traditions ever held were once pragmatically vital and they may become so again. The Immaculate Conception of centuries ago, which now to most seems moral *allotria*, was once vital, so were at certain times and places belief in the resurrection of Lazarus, the conjuring of devils into swine, Jonah and the whale, the sun standing still on Gibeon, the temptation in Eden, etc., but seen now in their true significance and motivation, they fairly glow with ethical light and heat till their patent is forgotten in their latent content and meaning. Man's soul is in all periods vastly wiser than it knows. The Trinity in the sense Kant regarded it was trivial, but its philosophical implications were developed by Hegel later, who made it almost basal. It was

the psychology of centuries projected on the heavens, and theology is now being reconstructed as a precious part of the higher anthropology and heaven as the millennial feature of evolution. Much of Man's dialogue with celestial and infernal powers and personalities is coming to be seen to be in fact only his monologue or soliloquy to himself set off as an imaginary interlocutor. In this new sense we must know God and all supernals rightly to know ourselves. Kant had hardly a foregleam of all that archeology, diplomatology, the higher criticism of the psychology of religion have since done here and hence his mode of dealing with religion is too summary and superficial as well as too logical and mechanically anti-genetic. His intellect was too dry and his soul too wizened to do justice to so vital a thing as religion. His treatise to be sure has had immense historical significance for it loosened the mental soil which theology had trodden down so hard about the religious life and it also provoked the reactions of the warmer hearted Schleiermacher and Jacobi, but in the above, he says little or nothing at all to the modern scholar in these fields and still less to the Christian save what is really elementary and commonplace. We are far beyond all this today and yet there are tyros just awakening to what religion really means and says who need this infant food till their mental teeth are cut. Perhaps the simile of a rubber ring to chew to facilitate dentition would have been better.

Again, religion is more than one specific way of regarding duties, viz., as divine commands. It is not a theory or feeling as to the origin of moral obligation. Kant's argument is that they are not divine and hence religion, as he conceives it, is based on a lie unless indeed this illusion of their celestial origin is only another postulate, false in itself, but justified because it works well to make believe that conscience speaks with the voice of God. If one assumes *vox populi vox dei* would that make public opinion religion and if not, why not? If we regard the flight of birds (Bryant's sea fowl), the inspection of entrails, the marvels of instinct, as God-guided, does it make comparative psychology into a religion? Would Malebranche's occasionalism, which assumed a special creative invention every time soul and body interacted, make all studies of the relation between soma and psyche theology? Is there no true religion without belief in or a theory of God? Is piety nothing but a supernatural sanction of human duty and has Deity no function in the universe save to motivate good conduct in men? In these days of religious psychology to ask such questions is to answer them adversely to Kant,

for it has far transcended the narrow limits he prescribed for it.

Turning now to the third Critique fantastically termed that of the Aesthetic Faculty of Judgment, dealing with the beautiful and the sublime, the term "aesthetic" has its more common art significance rather than designating the sensory field as in the first Critique. First as to quality, beauty must give disinterested satisfaction and it wakes no desire as to the agreeable and the good. There is here no motive to realize anything. Quantitatively, a thing of beauty must please all, although this universal validity is not conceptive but subjective. All these judgments are therefore individual, as to relation; we must feel a general, but not a specific, sense of design; and modally, the satisfaction must seem necessary. The object not only may but must please. Thus all judgments of taste are based more on feeling than on thought.

How false all this is! When we contemplate beauty, do we not either desire to get nearer, more of it, or if it is a work of art, to create it or a better one in the same or in some other field ourselves? The lives of great artists show that the exquisite joy of beholding beauty was often the muse that gave them their first inspiration, and their direction for life. The hedonic narcosis of Schopenhauer is painful and pathological if it does not inspire to create or do. Again, pure passivity in this field is psychologically impossible and perhaps it is in any other. Even the reveries in hearing music are partly of doing, although often in very different spheres. There is no paralysis of will and no *nepenthe* of desire, but we are at least made to feel better and stronger. We are interested and want to realize.

Nor is it essential that we feel that the object should please all. We know and feel that this picture, e.g., would please children and this combination of colors, savages, etc. The best tastes differ greatly. Cannot I fully enjoy music and yet know that there are those who care not for but are positively pained by it? We wish but do not expect all others to admire as we do. As to relation, the design instead of being essential is, as Helmholtz showed, often a detriment that designates a cheap and spurious art. The very suspicion that the artist planned it all out interferes with the far deeper pleasure that we want to feel and do when we feel that the creation was a spontaneous, irresistible and perhaps unconscious expression out of the very depths of the soul. For thus it makes us feel that the foundations of our being are sound. Thus unpremeditation is one of the great

charms of art. As to the necessity of universal appreciation, do we feel that all not only may but must appreciate the object we call beautiful? If, as Kant says, all these things are feelings and not conceptive, why apply judgments to them. All these are at best only a few descriptive phrases and his hypersystematization here is almost affectation. These platitudes have contributed nothing whatever of value to aesthetics, but have served greatly to retard the day of experimental methods here and have kept this field a tumbling ground of arbitrary individual speculation, often even of romantic constructions which have brought the subject into scientific disrepute. Writers galore have mused and set forth in ponderous tomes their complicated states of mind so long that a few decades ago many felt that this whole region must be given over to dreamland since fantastical, arbitrary and capricious methods and results seemed to dominate.

The *sublime* deals with what is great beyond comparison or indefinite and so is not found in nature, which can only evoke it, but in ourselves. Now, quantity is the chief category, as quality was in judging the beautiful. Whether mathematical or dynamical, we prefer the formless to form. After a negative result of inhibition or a sense of insufficiency, we are impelled to assume a *supersensible substratum* to which we cannot react adequately, even by the imagination. Yet we are pleased to realize that our reason as over against sense can cope with the object. Nature is great, but the soul is superior. Thus quantitatively the sublime is absolutely great, as seen by simple intuition rather than by enumeration or measurement. Qualitatively it pains, then pleases. Relationally, we feel greater than nature and modally, we all must feel the same. Thus all experiences with the sublime are a little harder than those with the beautiful because it brings the negative pleasure of self-subordination. Here, too, the logical mechanism rather interferes than helps.

At this point, the careful reader will probably first think of Kant's starry heavens and the moral will within which he deems the most sublime of all things. Under the above rubrics, the heavens themselves are not sublime for they are only geometrically and dynamically great, that is, they are merely symbols of true sublimity, but if the sublime is within us, why do we feel the initial pain of being insignificant? Modern psychology makes this reductive effect on the self a prime trait of the sublime, which has two directions, one toward what is objectively and the other toward what is subjectively great. The former need by no means transcend all

measurement or be great beyond comparison. It does not detract from Niagara that we know the number of tons of water per hour or a bigger fall in Africa, or from the sun and moon that science can weigh them, or from the stars that we can approximately measure the distance and the size of a few of them. We still feel awe without Kant's absolutism and infinity. Moreover, awe itself has many degrees. It is attuned with fear and hence we feel our insignificance, are depressed and paralyzed, perhaps feel the sentiment of extreme dependence that Schleiermacher made the taproot of religion. To feel awe thus requires certain generous powers of intuition that some seem never for a moment throughout their lives to attain, those namely who never can truly reverence, revere or respect. This involves docility and perhaps in its extreme forms almost a masochistic passion for pure passivity. Desire is instinctive will subjugated to the sense of objective reality to which all is fundamental. It is the subjective idealistic trend of post-Kantian philosophy that has impoverished the treatment of the sublime along with outer causes and has actually weakened this sentiment.

As to the subjectively sublime, our interpretation must today differ radically from that of Kant. Of course it inflates the soul well toward megalomania to think and feel that the grandest objects that seem to be without are really within us and that man is the bearer not to say the creator of his universe. But this is only a delusion of greatness. The conviction or sentiment that we are superior to instead of a part of nature gives only a meretricious sublimity. The true feeling comes with the realization that our thoughts, feelings, will, etc., indeed all we do consciously, are determined by the deeper, surer, stronger processes that work in the subliminal depths of the soul. This is a sense of an energy within, not over, ourselves that makes for truth and righteousness. It is the sense that underneath all our endeavors are everlasting arms; that if our frail bark of consciousness and purpose go to wreck, it sinks to a larger sea, that the racial, i.e., all the propulsive tides of heredity are steering us, and ever seeking to come to expression in our lives. The deeply infused sense is that we see, act and feel, etc., with all that all our forbears have seen, acted, felt, etc., and that these instinctive impulses steady and sanify, even if owing to the interferences and battered rectifications and accommodations of consciousness they do not always lead us aright. Let us then reverence the starry heavens above and the psycho-physical heredity behind us as the two primal sublimities, one in

space and the other in time, neither of which need or even can possibly be transcended.

Two other points remain in Kant's aesthetics. First he urged that the beautiful and the sublime give an impelling sense of a supersensible substratum back of the phenomena which evoke it. Essential reality, in fact the *Ding an sich* hidden to the understanding, comes within the range of these judgments, although this is not definite or even demonstrable. The concept of this substratum is always present, though always so vague that we cannot dispute about tastes. It was in carrying this view out that Schopenhauer said that in beauty only we glimpse the blind but basal will to live that makes all the processes of the world go. In the aesthetic domain alone does the veil of Maya lift a little or at least grow thin so that noumena shimmer through. The sense of reality has much to do with overwhelming us when we feel the ecstatically beautiful, or the transcendently great, says Kant. This ipsissimal entity is what is vaguely recognized. These two sentiments then bring us face to face with the metaphysical nature of things. We transcend experience and break through the categories only at this point. The artist passes in where the epistemologist cannot enter. The poet is a seer who can discern what the philosopher or scientist cannot and alone stands in immediate rapport with things as they are.

Our gloss upon this thought:—it is gratifying that Kantians can touch actuality at any point even in matters of taste, almost as if by palpation. The idealist should be very grateful after the long voyages of discovery that unlike Vanderdecken in the Flying Dutchman, he can make a landfall and be blessed, not cursed, for it, even though when upon the solid shore all is foggy and dim about him. But he now has *terra firma* under his feet and it is no wonder that with this only outlet from phenomenalism aesthetics has since tended in this direction as if it were in a hoppo. Here idealists have been impelled to reinvigorate themselves, like Antaeus by touching Mother Earth. Post-Kantians who felt most shut in found this the easiest way of escape and took it. It was thus Kant came to found subsequent philosophical aestheticism. It meant for his followers quite a general jail delivery. It must however be said that they have all together added precious little to our knowledge of anything in this field, least of all to the supersensible substratum. They have gamboled freely about, but always nearby, without organizing any expeditions to explore this mystic region. The little they have told us of the substratum is neither significant nor ap-

petizing. Indeed, they have really done little but exult in their new sense of freedom.

But reality is not the peculiar appendage of the sense of beauty and sublimity. In fact, the reality thus found is mythic as the grail. A sense of the real reality comes from hard up-against-ness of facts such as welfare workers, laboratory people, scientific managers of industry and business know. This kind of reality is the sternest, nearest and commonest of all things and that in Kant's cloudland of the imagination was only a mirage of it. The manual laborer is nearer to the only true *Ding an sich* than the thinker, poet or painter and what the thinker postulates or the artist glows over is only the remote resonance or phosphorescent effect of this kind of long contact with things from thigmotropism up through all our lines of descent generalized and beatified for contemplation. Kant's own diathesis here as everywhere may be described thus: His consciousness shed an unusually bright light and he examined his soul by its aid with great diligence, but his instinctive *Anlagen*, the lush impulsions within him, in fact all the emotionality and the crasser volitional faculties were so weak and inadequate and the unconscious subsoil of his soul so very shallow that he underestimated it in others and allows it almost no place in his system. His factual contact with life was faint and over small and widely separated surfaces, so he idealized in his aesthetics what he lacked in life. The tinglingly alive man exults through all the Kantian rubrics and in the envisagement of every aspect of nature and of life with a feeling of the supersensible substratum of it all. He does not need to see the world done up in song or framed in a picture in his study to appreciate it. Art only interprets what life means or ought to mean directly in and of itself and it does so only feebly and in patches. Beauty simply intensifies life, gives it all its relish and warmth and vital soul, sees both it and sublimity in all reality, in the meanest flower that grows, in all that lives and is. Isolation and undervitalization or both reserve these feelings for special fields.

Finally, do we feel a supersensible substratum more in beauty and sublimity in which with most laudable optimistic intent Kant reconstructed its avatar? Do we not rather feel it far more in those things that give us pain? Unpleasant are stronger and more varied than pleasant feelings and experiences and if there really be any sense of reality more coercive than another, it is that which we feel toward objects or facts that hurt us. It would therefore have been better

psychology for Kant to have said that tragic experiences reveal the supersensible substratum more clearly than the sense of beauty and sublimity can do. If Kant had located his sunken treasure of the *Ding an sich* in the tragic domain would not those who have since so diligently spaded for it have loosened up far richer soil? "Those who never ate their bread with pain know not the eternal powers" said the far more aesthetical Goethe. Is it not plain that where man has most transformed the world, viz., in industry, invention, discoveries, in social and political organization and throughout the whole struggle for survival in the natural as well as the moral world, which has decimated all species, man included, the sovereign master, pain, has been supreme? This is where pressure in foot pounds against reality has been hardest and not in the individual self indulgence and luxury of contemplating poetry, art, beauty and sublimity.

The other motif is Kant's argument that the beautiful and sublime are after all and at their best only symbols of the good so that as before religion now here aesthetics is ultimately resolvable into ethics. But what now becomes of his former argument that beauty is utterly disinterested and is thus distinct from the good in which we are supremely interested and which awakens the desire to realize it? How, if this is true, can morality be simply good taste in conduct? If the supreme beauty is goodness, we should be supremely interested in it and not disinterested and again, if in beauty we glimpse the supersensible substratum, why does he here reduce it to a mere symbol of goodness? This is surely a *contradictio in abstracto*. No reconciliation between these positions seems possible unless we assume that the *Ding an sich* of beauty is a symbol or type of a still more essential *Ding an sich* of virtue so that we have a hierarchy of entities. Moreover, beauty pleases, but pure oughtness can never please and remain pure. The only escape from this dilemma is to re-formulate on a more natural and modern basis the relation between the two and this involves a rather radical reconstruction of the whole Kantian procedure here. In fact, it is right to say that they are diverse, yet overlapping. There is an art for art's sake, as there is a duty for duty's sake. The difference is more fundamental than the identity. The Kantian beauty is all passivity and its goodness all activity. So each must get by as well as get on to the other (if slang may be applied to things so serious). The beauty of virtue is only seen in contemplating it and the act of doing it has no beauty to the doer at the moment. If it has beauty, it is only for

the beholder and if it has any for the doer, it applies to his deed as seen by him beforehand and afterwards.

Neither can be subordinated as means to the other as end, or as species to genus. One important distinction between them is that duty and the good are more closely related to the present and beauty to the past and future. Beauty consists subjectively rather largely in the awakening of reverberations from the past of the individual and of racial reminiscences in him on the one hand and of anticipations of the future, personal and racial, both of which must be of a predominantly pleasant character. Objects that recall ever so dimly paleo-psychic traces of what has lapsed to rudimentary states or organs in the soul or that awaken general tendencies not yet ready to flower, are beautiful. Thus beauty deals largely with two important classes of psychic objects, viz., vestiges of long ago and buds or promises and potencies of what is to be. This does not necessarily or usually involve any conscious memory or even *déjà vu* feeling. It is often quite impossible to distinguish the ontogenetic from the phylogenetic factor. It is this survival of often massed genera of experiences rather than specific occurrences that have tended to survival that is properly aesthetic. Lost chords are generally sounded again and the soul unconsciously remembers its lost paradise, that is, the best of its past experiences. Now, could we analyze these, they would probably be found to contain much of sex and its wider irradiations, for much of beauty has in the past been correlated with primal and secondary sex qualities and acts. Beauty is in no mean part made up of massed and confused echoes in the soul of what love has been and done in the world all along our line of forbears. It is of old, glowing, haloed, transfigured, a beautiful object. Love is not only the mightiest power of the soul, but the most persistent in the sense that its relics or engrammes are longest perpetuated, but it is also the most plastic, transformable and metamorphic of all. It can be base, sensuous or spiritual and felt toward the good and true as well as toward the beautiful, which contributes so much to give both the affective element. The study of sex aberrations shows that there is hardly an act in human life or an object in the world that cannot and does not in some pervert evoke specific erethism and it is due to this general diffusion and tendency of love in normal souls that it may suffuse anything with special significance for feeling, that is, it may sanctify, beautify or give conviction of truth or underlying noumena, for all of these love can do as nothing else can. And what

did Kant know of love? Without love, how much beauty would there be in the world? How its joys are diffused through woods, hills and vales, shores, mountains, morn, sunrise, sunset, twilight, moonlight, water and landscapes and all scenes in which its ecstasies have been set! It intensifies life, gives the world item by item its emotional view, makes life worth living because it has been and is possible again. In beauty, love is purged of desire and is often little but love of love, and the vast variety of objects from flowers to beautiful human forms are its best symbols, but everything can become so. It makes heroism, speaks through the individual, but is eloquent of the race which is always its real theme. This is the genetic and the prophetic aspect of beauty is hard by. Beauty is thus the sublimation of love and can be perfected only in the future in which, if at all, it will be its apotheosis. Thus, in all experiences of beauty, we step out of the present and to a great extent out of the individual life to expatiate over the wider racial field and recover what was lapsing over this almost boundless domain. The person touches the genus. In duty-goodness on the contrary, we take the issues of the race into the individual and more than that, focus on the *devoir des devoirs presents* and act in the living present. It is not now a question of contemplation, but of doing. We impersonalize ourselves more intensely rather than depersonalize ourselves. It is choosing between and executing deeds and it flourishes most not in quiet but in stirring times. Will takes precedence of feeling. Much, perhaps most, that beauty inspires is unrealizable in the life of the individual, but duty and moral goodness can and must ever be at least approximated. To do no evil is not enough. There must be achievement. The real saint is not idle as the beauty envisager may be. Sanctity and holiness are cheapened if called merely beautiful. The anchorites often outraged the aesthetic ideals of human life and courted ugliness, feeling that they did not belong together, but were opposed, for they thought life must be depurated of beauty somewhat as Kant thought the highest virtue must be of happiness, but they had no aesthetics even where the two could come together. Today we should hardly designate that life as beautiful that was devoted to the strenuous practice of virtue. Art may include, but it is more than morality taught by example. Thus the dear old little sage of Hinter Pomerania gave us neither paradigms nor rescripts for the relations of these two mighty potencies in the soul which our age can use.

Beauty is more closely connected with religion than with

morals, but not with Kant's narrow conception of religion. If beauty is *amor redivivus*, if it may be sublimated as Edwards taught even up into love of being so that "he prayeth best who loveth best," or focused in the great personified moral hypothesis of God, if the best form of worship is that which is the most aesthetic and if a large part of the work of religion in the world, especially Christianity, is to keep love pure, and since the church has inspired so much that is best in all the arts, it would seem that we are now compelled to seek for a deeper bond between them. The very pathologies of the two are akin. Let us begin by roughly characterizing religion as the *art* side, aspect or complement of morality. All its persons, states, places, events are artistic creations not so much of the great religious founders as of the folk soul. So far as genetic psychology can now see, religion is made up warp and woof of imagination. Of the might and dignity of the imagination, Kant knew almost nothing. But religion has always understood its potency and long ago cherished its highest moral function, faith, "the substance of things hoped for, the evidence of things not seen." No philosopher, save Froschammer, who thought the imagination actually cosmothetic or world-building, even began to do it justice and he treated it too much in what we must now almost call the vulgar epistemological sense which construes the world according to subjective or absolute idealism. Psycho-pathology is now realizing its power over health and disease. To say that God, devil, hell and heaven, immortality and all the rest are products of the ontogenic but still more of the phyletic imagination by no means is to assert that there are not real transcendent objects corresponding to them. On the contrary, we might argue precisely as Anselm, Descartes and so many others since have done, that because every race tends to evolve such objects we have a warrant to believe in their objective reality, else the soul is made to lie. This argument is just as pertinent for such products of the imagination as for those of reason. Their independent existence lies in the field of metaphysics or is at least metaphysical and thus belongs to another domain. A critique of these projections of the folk soul is now in order and must be forthcoming, but when it has done its perfect work, it will only sift out those mythopoeic products that are moral from those that are not, those that are universal, that are illy developed from those that are not, for they constitute the very essence of true religion. The hedonic narcosis of these moral art forms that the soul has felt toward Jupiter,

Thor, and Jehovah is worship (worth-ship) or the ascription of supreme value. The fashions in gods and in the interpretations of the God-idea or the attributes stressed change from age to age, more so perhaps than do tables of categories and certainly more than the best formulations of science. But under this change there is in these objectivizations always an essential core that abides. The changes in this domain are pragmatic rather than logical. All these cults, rites, ceremonies are only old conduct or forms of etiquette and deportment toward deities and hence they are imagined celestial morals. Religion thus beautifies and makes sublime the personifications of the system of virtues of those people who hold it. Thus, while aesthetics includes, as we saw above, only a part of morals, it embraces all of religion. Theology is the anthropology not of man so much as of the great and good section of humanity projected into the cerulean vault. It represents the best of mankind generalized and apotheosized and this is the product of constructive imagination, which makes up its very warp and woof and without which all the pure constructions made by the religious consciousness would, like the airy fabric of dreams, vanish and leave not a wrack behind. Only great and ethical geniuses can work transformingly in this field. What we find here is largely the result of masses of men working unconsciously and through generations. The Kantian logical reason is far too clumsy a tool to work with this material and only a psychology that has come out into the vast genetic domain has now begun to develop the methods and the conceptive apparatus which promise at last and ere long to do it justice. We post-Kantians have almost lost ourselves prowling in the narrow field of consciousness like Dutch patchers under the dikes of logic, which keep out the great sea of truth, but in these days the unconscious is coming to its rights and is bound, if not to be a trifle reckless, to indulge the imagination in making a periscope of possibilities, some of which will ere long become highways of science. The church invisible, the millenium, the judgment day, rewards and punishments and all that pertains to the fate of the soul at and after death, all modes of doing business with the gods and the gods themselves are products of the moral aesthetic, just as atoms, ions, ether, etc., are of the scientific imagination, and the criteria of the value of both is the same, viz., service. In both these realms we must walk by faith, not by sight. Thus, if in these pragmatic days we are learning that the old theory of knowledge and metaphysics was in large part an extravasation

of thought, the genetic psychologist in pronouncing its funeral panegyric must not forget that he owes to them a peculiar debt in that they have made possible a purely scientific treatment of the most sacred teachings of religion by discovering the noetic process of relegating all consideration of objective reality to another domain which he would not and cannot enter without ceasing to be a psychologist. They are like the extruded polar globules for him while he can study the pair that remains.

Further yet, the geneticist sees in the entire idealistic movement, from Berkeley on, only a propaedeutic for religious psychology. All that these thinkers proclaim concerning the phenomenality of the external material world they really meant of the religious cosmos. Their patent content, when psycho-analyzed, reveals as its latent content the fact that the *esse* of the spiritual world is its *percipi, cogitari* and *sentiri*. In fact, the power of the whole world of revelation, dogma and doctrine was fading and the idealists interpreted this *débacle* of faith objectively as a decline of external unreality. The geneticist must ask why they did thus misdiagnose and misinterpret impending spiritual bankruptcy and direct their scepticism toward the natural when in fact it was rooted in the spiritual realm? Why did the lush confidence of the physical science in this when the world of the religionist was fading, not suffer them to sleep, like the laurels of Miltiades? Certainly crude conscious jealousy is not a sufficient answer. We must look deeper for the true psychic momentum of this metathesis. The lover whose mistress has filled all his soul till everything in nature " 'minds him of his Jean," when he feels her going away from him finds the world desolate and unreal. The morning song of the lark the rose, dawn and even twilight lose their charm and do not appeal as before. So the soul which, according to Augustine, supremely longs for God and if he is found rests in him, finds all nature transfigured and when God is lost, finds the world fading too. So in the last half of the eighteenth and the first part of the nineteenth century religion and the church, owing to the later results of the Protestant defection, were losing the dominant power they had so long wielded over the soul of man and an intellectual void and an atrophy of heart were superseding. The God-love of cultured Christendom was waxing cold as its object paled and the soul was distraught and disoriented far more and more deeply than it knew. The royal sentiment of conviction was passing over from the domain of faith to that of science. The ark of the

Covenant that held the decalogue was captured by the Philistines and must be won back, for they would never return it voluntarily, as was the case with the ark of old. As the very song of the sparrow erstwhile so cheering to the lover, threatens to break the heart of the rejected swain who would now silence it, so the apostle of the lost older *Pistis* and the newer losing *Gnosis* were tormented by the naïve confidence of observers and experimenters and so instead of reestablishing the spiritual world that had been shattered, they first made an aggressive and destructive raid against the camp of the materialists. But as I said, it was not the mere unconscious jealousy of the new organon of knowledge on the part of the baffled representatives of the old one. The latter like those who suffer from bodily diseases honestly mistook symptoms for a true diagnosis of the nature and cause of the disease. The world without God, heaven and the rest had lost its reality for them. Its old meaning was gone and they could not find or at least could not formulate a new and higher one, for this was the work of generations of thought and research. The faith-world had to be rebuilt slowly, step by step and so an interim scheme must be more hastily evolved to save the remnant of the provisional scheme till the day of new realization dawned. Thus the idealism of this age, later to be psycho-analysed in detail, vicariated for faith bankrupt and led into captivity in a strange land. Thus the objective world seemed phenomenal to those evicted from the old one which had been equipped with all the traditional products of the racial imagination before their psychokinetic equivalents in the form of the new statements was found. It took faith a long time to find and make a new home and equip it with new Penates with which the necessity of belief in some kind of creed could be met. The old idealism of the romantic speculation of the heroic age of modern philosophy was thus a regency and is not yet entirely ended, nor will be till genetic psychology is able to establish the old verities in forms palatable to modern thought, that is, to provide new and adequate proxy formularies.

Again, the old religion had glorified man by making him eternally perdurable in another world and as that great hope grew uncertain, he could not allow himself to be divested of this transcendental importance and so invested himself with a new halo of glory in the present world by making himself nothing less than the bearer or creator of it. Indeed, it was made of mind stuff to idealists. Never was such a regal crown offered to man as when his intelligence was made the

organon of all the categories, the maker and projector of the world of sense and even of gods. This was done as a consolation prize for his growing uncertainty concerning the next world. Plato said the soul was so marvelous a thing that even the gods could never have the heart to destroy it and somewhat in the same vein these philosophers, in making the mind cosmothetic and even theotic, were atoning for a dim sense of loss, and seeking to meet the old need for wish-bred convictions in a new way. Both subjective and objective idealism conceive the human soul as the very apex of the universe. Instead of having his dignity conferred upon him by the gift of immortality man now puts on his own crown of dignity, which he deems so great that he may base upon it his assurance of an hereafter. Instead of being a stranger and an alien here bound for a heavenly home, epistemology made man the pampered petted spoiled child of this world, saved and preserved in the next because he so wanted and expected to be that he must not be disappointed. Indeed, he was too marvelous and precious to be annihilated. Meanwhile, there must be no rival with which the verities of the old faith even in its decline could be compared to their disparagement. Those dissatisfied with the ideal world must not be exposed to the temptation to turn away and gratify the passion to believe, which is so irresistible to every ingenuous soul, in the baser things of sense perception. Thus the speculators of this age were tempted to disparage the studies of the world because they could not solve its problems to the end and pass by strict methods all the way up the long road that leads from nature to nature's God. This they might have done had the biological, psychological and social group of sciences been developed, for in the light of their higher interpretation of even physical science, all would have been easier. The alternative then was either mathematics and physics or morals and religion. Now this gap is so bridged that there is no such alternative, but continuous passage, thanks to evolution, such that if the senses, which are so basal, are undermined the whole superstructure falls and he who attacks the witness of the eye or the ear imperils the kingdom of God. Sense is the fore-school and not the rival of the new faith and the Author of the world does not say one thing in the language of his deeds in nature and another in revelation, but both are parts of one consistent continuous whole, neither complete without the other. Everything in both fields is a problem to be even further investigated by kindred objective scientific methods. The idealists

perpetuated the old disastrous warfare between them which, as Mr. White's book has shown, is the tragedy of the Christian ages. They devised new weapons, fought the old battles in new and higher fields. The science of their day was not only narrow, but nearsighted, ever tending to crass empiricism or to formal deductive mathematical methods. Science then was utterly unable to cope with vital problems or to meet social needs. Hence the struggle that Kant sought to adjust was not ripe for adjudication and the terms of his truce seem now little better than learned scholastic jargon and those who study him too intensively as a finality are held up as it were in a past age, slaying the slain and crowning the victors over again. They are thus kept from vital touch with the living present. Miracles, inspiration, immortality and all these questions of our own and other faiths are now studied by psychologists natural-history-wise and also by analytical methods which chemists and engineers respect. Scientists have had the grace not to attempt to lay down laws of procedure to their philosophical colleagues, although they have the most venerable and trusted of all oracles, mathematics, on their side. The soul students on the other hand have not yet learned to forbear the wasteful and absurd effort to prescribe this for the former. In fact it is more to Kant's influence than to any other source that we still have the too common spectacle even today of young theorists of knowledge making pompous proclamation to scientists as to what they can, cannot, ought, ought not, know and do, what axioms, principles, concepts, methods they should use and laying down comprehensive surveys of scientific results and prescribing its logical canons on high *a priori* grounds, even for the laboratory. (I hesitate to mention a long and growing list of names and titles I have collected during the last five years of those who thus assume the right of eminent domain over the whole scientific territory; like the hero of a Gilbert-Sullivan opera enumerating another set of preposterous or typical faddists, "I have them on my list and they never would be missed." Better half a term of physics than a cycle of this Cathay!) Did any man of science ever profit by or even read of these erudite lucubrations, these solemn adjudications or high *cothurnus* injunctions which to those who do saturate their minds with them give the most vacuous of all the many forms of the conceit of knowledge without a suspicion or even the most diluted tincture of its substance?

The Kantian epistemology is thus only an attenuated or

sublimated continuation of the old warfare between religion or rather theology and science (which Draper and A. D. White have described) brought from the transcendental into the realm of immanent soul life. The old naïve Greek confidence in life and the pristine nearness of rapport with nature is here challenged in the interests of categories instead of supernal personalities and post-mortem states of existence. The old and crumbling partition in the soul between reason and empirical reality instead of being allowed to fall away and be forgotten is cobbled and patched up and the solidarity of interests and the intussusception of growths which now tends to go on between them have been retarded. The Kantians should profit by considering the fate of the old theologies and orthodoxies and this quaint system should henceforth be studied only historically and analytically as a precious product of the *Zeitgeist* of the past rather than of our own day, the interpretation of which latter is our crying need.

Before leaving this Critique, we may ask why we need to believe, for it is not, as James urged a *will* to believe, but something deeper which his type of mind (so blind to every evolutionary aspect of life) so tinglingly and completely expressed and confessed in his extraordinarily developed self-consciousness of his mental processes. The answer is, "We *must* believe, i.e., we must add *pistis* to *gnosis* largely if not chiefly because and just so far as we both as individuals and as members of a stirp are not yet fully developed but have a future greater than our past." Those on the other hand who represent the last stage of human degeneration cannot have faith, for everything for and in them has been realized, their entelechy attained. Every superstition, *Aberglaube* or extra or superfluous belief is instinct with the fore-feeling of greater things ahead. These things constitute the soul's feeling of being pregnant with the superman yet to be. They are taking and staking out squatter rights, preempting domains in new regions felt to be destined to become seats of empire later. But the last man exhibiting a later stage of human decrepitude and doddering old age will not have or find faith on earth, for faith is the spoon food to fledgling faculties which have not yet cut their teeth and can only mumble solid pabulum. Nascent stages of the soul's long upward viaticum need tenuous because tentative objects, platonic myths, even dogmas which they can believe because they are absurd, to keep the mental sutures from knitting together prematurely. They need a domain where they can flout reason and even its very best interpretations. Just here lie

the powers and potencies of the larger science that is to be. Every growing mind then ought to have one or more surds in its composition, if only used in the sense of what piano tuners call the "wolf" or the key into which all the discrepancies between the natural and the tempered scale are tuned. Thus science unsupplemented by imagination is a moribund thing, for the latter is the organon of the heart, which has in it not only greater but more dimensions than the intellect; and Kant was a pure thinker, almost a man without heart and moreover, the day of the study of feelings had not yet dawned. Yet as feelings are never to be repressed, they dominate, though only in the form of tendencies, or determinants, directing the form of about every position which Kant took, as psycho-analysis, which consists largely in finding the feeling motivations of thought, is beginning to show. These things really motivated all that what he called pure reason did.

Once more, the world will not accept any hard and fast distinction between what is true to live by and what is true *per se*. Science of course knows no such distinction. We do not easily accustom ourselves to the idea that certain things are verities and others that are at variance with them and utterly undemonstrable are true as postulates for conduct. We want to wear in our daily life mental goods that will wash and do up well in the laundry of reason. Otherwise morality lacks impetus and is falsetto. Such a schism is too much like the old distinction the church long made between the verities of reason and those of faith. It involves incipient duality of personality. We must know whether an author is talking in his first or in his second manner, voice or register. Pragmatism would obliterate this distinction by making practical truth not merely supreme but all, but pure reason and science can never be all reduced to practice, can never be entirely pragmatic, nor yet admit of two standards or criteria. Now Kant must have felt that his postulates were built upon foundations of sand and hence sought to compensate by the *Überdeterminierung* which appears in his compulsive and imperious categorical imperative and also by the very position he took that the practical was higher than the pure reason. This, be it noted, he did with of course perfect conscious sincerity and without being aware of the deeper motive but he could have done so with plenary conviction from the psycho-analytic standpoint. He was too logical a thinker not to be intensely subconscious of both his standardization and the handicap under which it made him

labor. The knight errants, it is said, often fought hardest and with the blindest abandon for a mistress whose reputation they dimly felt or even feared to be a little questionable, in order to fight down their own doubts by overcoming the authors or mongers of scandal. So too, on the same principle, young Mormons, if they show to the elders of the church the slightest signs of growing skepticism of their faith, are sent out as missionaries because it is realized that by convincing others they will most efficiently convince themselves. Thus Kant became most enthusiastic against his wont and temperament as a toreador of virtue because his oughtness lacked the sanctions of his logic. *Sustineo quae abstineo*. In the second Critique only he wrote a lapidary style or to change the trope his weft of thought is highly painted and embroidered by affectivity. After saying that freedom, God, immortality cannot be proven or disproven, he postulates them as the *only* basis and justification of virtue. Now, if an inquisitor of the old days had said, "Very good, therefore these must be enforced by an *auto da fé*" what would Kant have had to object? Rather must he need have applauded. If certain beliefs are essential to good conduct, even though they be ideas that ethical culturists deny, why must not such beliefs be enforced by the very same authorities and the same pains and penalties as the virtues to which they are basal? Again, one faculty of the soul cannot thrive when acting under the conviction of folly by another. We cannot think by one set of categories and act by another however named (principles and postulates). Hence here again Kant must be convicted of putting asunder (this time more violently than in divorcing the sensory and the understanding) what God or nature joined. To act *as if* God, soul and freedom were real is the nursery way of postulating Santa Claus, Jack Frost, the black man, the stork baby bringer, etc. More yet, these Kantian hypotheses are justified on the same principle as the rabbit's foot, the horse chestnut, the red yarn around the neck, which are true if, when, and in so far as they work well, that is, make the right tonic and therapeutic appeal to the imagination. Once more, if philosophy is the system of facilitations or *Bahnungen* connecting all parts of the brain and thought by methods of easiest and most rapid transit (making a degree of unity and efficiency of thought and conduct that is nearest to the standard always set by the economic operations of organic life where staff and line methods are best combined), then Kant falls below the standards already attained by empirical genetic psy-

chology, which knows no such schism, and his scheme for us as a whole is a clever curio but at the same time a serious warning to us, whatever we do, not to sin against the integrity of the soul. Its parts must be knit more closely together rather than disrupted. His is thus a dual, bifurcated, two-souled system and Hegel was right in accusing him of double housekeeping. One showed him to be a logician conjuring deftly with categories and the modes of the syllogism, while the other showed him to be a rarefied religionist whose theology, whose innate and early piety was distilled into rubrics of moral sanctions in which the dogmas are only sublimated or, to change the figure, adduced and used only as a set of collateral securities. Like Zarathustra he was alternately a denizen of two worlds, one of the cerulean blue of the true truth and the other the lower, turbid, murky world of accommodation to mortal needs.

Design, says Kant, is external, i.e., relative and mechanical; or secondly, internal and organic, i.e., where each part is at the same time end and means. Final cause cannot be explained mechanically in this latter domain. The opposition between the two theses—"all is mechanical" and "all is design" vanishes if both are conceived as only regulative or subjective and not constructive. We can never decide whether inner cause exists essentially in nature; we can only know that our judgment must regard nature as designed. To a mind that could not proceed discursively from part to part as we must, but which could look at all things intuitively and simultaneously rather than as proceeding from parts and individuals to the universe, or from the parts to a whole, etc., all nature would seem an *e pluribus unum* or as constituted by the same principle. Such a mind would not need nor indeed be able to form the idea of design.

Now if there is immanent design in nature or if immediate intuition of it is possible, then the standpoint of subjective idealism is transcended and his Critique of the faculty of judgment would be hardly less discrepant from both the other Critiques than they are from each other. What Kant only suggested here was taken up later by Schelling who severely criticized Kant's provincialism in philosophy, his ignorance of its history, even of Leibniz and Descartes, the unfitness of his scheme of things to be generally adopted, made cardinal and developed. In his first period Schelling himself taught that nature is visible mind and mind invisible nature, that there is absolute identity between them, that the same absolute ap-

pears in nature and in man, that there is no need of carrying over from one to the other, for nature is mind's *Doppelbild*. From these principles, Schelling derived the unity of all dualities and oppositions. Thus the objective world is independent and automatic and all knowledge is harmony of the subjective and objective. It is equally right to derive mind from nature and nature from mind. Matter is extinct mind which science and philosophy reanimate.

Kant was the first of the great quartette, the three latter of whom, Fichte, Schelling and Hegel, all in diverse senses and degrees lay concealed in Kant and in whom he stood revealed. When these later systems declined, the cry was "back to Kant" with the feeling that his work at least would not have to be all done over again. Kant did his best to reason out a coherent view of the world, to make a catharsis of all superfluities of belief and to inaugurate a new type of consciousness that should crown man with a new dignity. He was not like Schelling, impelled to utter as fully as possible every stage of his own psychic growth, moulting system after system, as he documented successive stages of his development with little care for the consistency or the conformity of one with another, thereby affording the very best of all data in the whole history of philosophy for psycho-genetic study, Plato himself being, considering the uncertainty that still lingers concerning the order of his dialogues, inferior to Schelling in this respect. If Kant's theories about nebulae (which seem to have been connected in his mind with his utterly baseless conjecture of one central sun in the universe somewhere, perhaps Sirius) involved in any sense a fore-gleam of evolution, Schelling's scheme of the ascending orders of life, applied by Oken in greater detail to the animal series, gives a far more interesting picture of "evolution before evolution." We have seen how Schelling began his work just where Kant fell short of transcending subjectivism. Schelling was a prose-writing poet of nature and of her relations to man, ardent as Kant was frigid, sanguine as Kant was bilious, as the old phrenologists defined these terms. Fichte suggests the reincarnation of the old Hebrew prophet of righteousness—magisterial, magnetic, eloquent, uncompromising, soldierly, patriotic, and he aspired to be almost an infallible pope in the matter of morals. He too wove, cut and made a unique suit of habiliments that just fitted his soul and set thereby new fashions in the realm of *Sartor resartus* which a few even today affect. Given such a man as he and who knows that the future psycho-geneticist and analyst

may not be able to predict with considerable accuracy what sort of a speculative philosophy he would evolve! No system in the whole historic series of them must have made the gods so jealous as Fichte's, for his heaven-storming, world-creating ego seems to involve the unpardonable sin of the old Greek dramatists, that of rivaling heaven and thinking thoughts unfitting man's estate. Had Fichte lived under the reign of Zeus, he would have been blasted by his thunderbolts, or like Prometheus chained to a solitary rock. The most absolute of all egoists, he was in all his *thun* and *sagen* the embodiment of Kant's categorical imperative which set out to construct a mode of knowing the world that should be not unworthy the supreme dignity of man in it. Each man's essential self is the ultimate monadic *thing in itself*, to make it absolute is his sole duty and end in life and moral deeds are supreme above the achievements of speculation. To give duty priority over reason in his day when rationalism was almost a mania, placing it above even the categories was indeed to install it upon the very highest of all pedestals.

Hegel too lit his torch at the light Kant kindled. Instead of a dozen he postulated many more categories, he assumed that instead of being isolated and independent they were not to be assumed as originally given or created, but that they were products of an evolution which needed a new logic to explain it, that their developmental history must be given to show that they sprung from a single source and were so connected that when all the missing links were fully restored, thought could have an organic unity unknown before. It was to this end that a new method and logic were devised as a kind of logos or world soul. This slowly maturing ox-eyed Swabian, like his great Catholic prototype, St. Thomas Aquinas, sought thus to more than think God's thoughts after him, to rehearse his processes in creation and to be his interpreter to the world. Hegel's God was the superpersonal Absolute or God as he existed unrevealed before creation and independently of it, very God of very God, as pantheists conceive him. Hegel's logic is thus the genetic psychology of this supreme Deity who inhabits eternity, as he forever was, is and will be, who not only *did* make but *must* make time and space and all that in them is for reasons that can be fully set forth, for as fate rules Zeus, so Hegel's logic is not only a genetic derivation, and construction of God, but also the constitution by which he must act. The Hegelian web or diamond network of categories laid bare the system of necessity back of and determining every process of the absolute

Geist. Idealism could go no further and there remained nothing more to be explained. Thus in Goethe's phrase, all the garments we see God by were woven in the roaring loom of time or we might better add that the X-rays for the first time were turned upon and revealed the ipsissimal nature of God. Probably never in the history of the world (outside Catholicism at least) has any philosophical system been so influential or dominated all the special sciences as did that of Hegel in the day of his perigee. Each department of knowledge was assigned its place, its method prescribed, each scientist was told what he ought to do and could and what not, was told what his science really meant. Everything was inventoried, evaluated and many things transvalued. Did the culture world escape more narrowly than it knew from a new Protestant papal dominion, organized according to the principles of scientific measurements and efficiency inaugurated by this autocratic privy councilor, to whom the monarch's court and even office holders did homage and to whose ideas about all professors in all departments had at least to define their relations, which some of them did with almost courtierlike obsequiousness? Yet all this was only Kant's soul marching on. The little cloud in a spotless sky the day he died, which a soldier said was his soul, had indeed spread over the entire German sky. This cloud, if one may quote so vile a pun, as Tom Hood said of George the Third, rained as long as it could rain and then it mizzled, and it mists even yet.

When the three great post-Kantians (not to mention Schopenhauer here) slowly declined in influence and their kingdom of thought began to break up it was natural that their disciples should raise the cry—"back to Kant," for he was the focus to which so many lines before had converged and from which so many later diverged. He was the solidest of them all and the cloth of glory he wove had the firmest texture, the best warp and woof, seemed compared with others of good measure, a yard wide and, as has been shown, washed well. Hence arose the neo-Kantians and even the Kant philologists who treated his texts as exegetes treat Scripture codices. This new-old base line upon which the army of idealists had fallen back had to be reconstructed, intrenched, fortified, provisioned with new facts from the newly opened, well tilled and fertile lands of science which had meanwhile been very productive. Vaihinger, Cohen, Uphues, Watson, Hartenstein, Wallace, Morris, Porter, Knight and many others edited, résuméed, explained and made a new

aftermath of Kantian literature. Kant was the last stronghold of the old Teutonic ultra-idealism where the old guard must make their final stand and win or die. Inverting the law of megalomania and delusions of greatness as laid down in a masterly way by Magnan, the persecutors have become the persecuted and even I in this note am perhaps unconsciously and more than I know feeding fat the ancient grudge I bear the big four for absorbing so much of the energy of my own best years, which might have been better spent and for the waste of which I am myself an awful warning against this peculiarly inebriating speculative debauchery. Outside the specific professional holophrastic followers of Kant, today there are many still, even in psychological laboratories, who seek to make new blends of science and speculation and subject even experimental data to epistemological tests as irrelevant as theological soundness is to biology.

The days of this confusion are, however, happily ending. The first great step toward betterment was taken decades ago when the new school of the history of philosophy, represented by Trendelenburg, Fischer and Zeller began. Realising that the old symptoms had spent their force and could never be treated or regarded as finalities, the new canons of historicity aimed to set forth every system of the past as purely a product of its time and its author, and as directed chiefly towards its contemporaries. To regard it as pertinent to the present was deemed antiquarian and to make any one of the old systems supreme as a form of psychic arrest. As the higher criticism showed that the Hebrew prophets expressed only their own time and never predicted or sought to do so, so all these systems historians sought to offer up on the altar of the muse of history as dead products to be studied and reviewed only if we wish to revive the past.

Now, however, we are just entering upon a new and still higher third stage of reactions to these old systems, that of critical analytic psychology which seems destined to become the new queen in this domain. From its most advanced position, viz., that of geneticism, it is beginning to ask what speculators really meant by what they said, for if this can be found, they may after all have sense and meaning for us. Geneticism brings a new key to unlock deeper meanings, which will show that the processes and results of the old systems are really symbols demanding a new interpretation, that that which the authors thought they were doing and saying was very different from that which they were in fact doing and saying. The impending analysis of all the great systems

is the inevitable result then of the new dominance of genetic psychology and owes little, save terms and suggestions, to the Freudian analysis of neuropaths and yet we must do the latter ample justice and there is one very suggestive analogy and difference between them. As Freudians find sex, so our analysis finds religion at the root of all. Religion is a passion of the soul comparable in universality and intensity with sex, like it subject to and even made morbid by repressions. Like sex too, religion has left the soul full of its secondary qualities which it originated and inculcated, but has often left later to stand for themselves, so that their *de facto* religious origin is not apparent. As much all over the aesthetic field is due to the long circuiting of sex, so speculative philosophy is only the long circuiting of religion, and its sublimation into the intellectual field. As the root impulse of sex is to propagate another generation, so the root impulse of religion is to prolong the life of the individual by getting his soul born into another world. Both are forms of Schopenhauer's will to live, which is the *Grund-Trieb* of all life. Heaven is a product of the nest-building impulse, for our souls are to be reborn in this celestial world which the folk soul has created and made ready for them. God is a uni-personal dynasty that insures safe transit to and land-fall in a gloriously organized and permanent home into which he who dies is ushered so that life is thus made transcendently worth while in the *Jenseits*. Virtue is such conduct and regimen as will make us sure of immortality and of being well and not meanly born into the next life. Ceremonials are other-world conduct and worship is mindfulness of and heartening ourselves by the thought of this destiny. Offerings suggest that we must give up some objects of sense here to insure happiness hereafter. Theology is the philosophy of the next world and is pure pragmatism, judged from its own standpoint. The church is the insurance society that prescribes the moral regimen conducive to postmortem existence and well-being. The struggle for survival beyond is thus a mighty power and religion is a system of selective agencies. Like sex, it has manifold perversions and fanaticism, it is aggressive or sadistic, or it is quietistic, passive or masochistic. Both have their fanatics, perverts and inverts (cf. Morse). Now to psycho-analyse a philosophical system of the universe, we must first of all establish a set of symbolisms or psycho-kinetic equivalents. For a personal God, we must substitute an impersonal power that makes for righteousness, the great revealer of all things. His invisibility is translated as his metaphysical noumenal

character back of phenomena; for explicit revelation we read immanent laws; for heaven, the attainment of our highest desire or perhaps the ideal state of the future man here, the fulfilment always of fundamental wishes, the *summum bonum*; for the love of passion, the *amor intellectus dei*; for immortality, the intellectual intuition that participates in God by knowing his ways, and the deathlessness attainable here which is not, however, personal, for personality is a lower category; for demonstration of the reality of the ego, the immediate sense that we think (*cogito, ergo sum*), feel free and responsible, desire pleasure and are averse to pain, and push on from the empirical to the absolute ego; for Scripture, the tomes of the dialectic philosophers; for priestcraft, the craft of the system builders; for confessors, their ethical theorizations; for sects, schools of philosophy; for tables of the law, tables of categories; for vision, speculation, which means looking on the processional of either thought or things within or without us; for indoctrination, rationalization, the desire to understand, accept and live according to the systems; for the Holy Ghost or spirit of truth, the logos or logic of the world; for miracles, the necessity of surds and postulates to be assumed; for the church, the philosophers' state. With such keys we translate from the religious to the philosophic consciousness or vice-versa. Of course this list of equipollent terms is by no means as yet either accurate or complete. Of course too the philosophers did not realise that they were at root religionists, fighting over again the old battles with naturalism, only with new and newly named as well as improved weapons. They and the church were ships that pass in the night and each thought the other hostile. Just how much the noblest of all the doctrines of Kant—that of the categorical imperative or autonomous oughtness—he owed to his mother's teachings concerning the still small voice of the Holy Ghost; how much his characterization of the sublime, his sense of his own insignificance when he was stargazing, was due to the old magnificats of the Almighty who inhabited eternity; how much the satisfaction he felt in beauty was suggested by the ecstatic contemplative state of religious mystics; how his practical reason is faith in new terms; his phenomenalism motivated by the religious *vanitas vanitatum* of world-sick pietists from Solomon down; and indeed, how far his very subjective idealism that exalted man as the bearer of the world well up toward parity with the God who created it, was only construing into this life some of the pledges of glory that of old awaited man hereafter so as to realise at

least partially here from the securities fully redeemable only in the next world—all this is itself as yet only speculation. But, whatever theme we touch we shall, if I mistake not, find it to be essentially a restatement in new terminology of ancient religious notions, so that the whole of these systems is religion re-thought. In all their polemics against science and in their disparagements of nature, they were really defending the interests of the church and it is high time that the church should recognize its advance guard.

The demonstration of this thesis in detail is yet to be wrought out. It is of course not claimed that religion is pathological. The justification of the above general proposition can only be carried through by long, painstaking labor. The inhibitions of religion have been many and strong, like those of sex in hystericals, although these great men of course are by no means hysterical. But their religious consciousness and experience give us really the clue which we must follow. If we trace out in their systems all the substitutes, and transfers, patiently detect every complex *Verschiebung*, *Überdeterminiertheit*, *Verdichtung*, *Censur*, etc., we shall realise the underlying identity of their philosophy with religion. These idealists really sought to set forth the latest and most advanced form of religion and their chief merit depends upon whether or not their methods were right and their results with these efforts were useful. That is the criterion by which we must judge them. Their views were only the sublimation of the religious consciousness.

The key of Kant's philosophy is his person, his age and his habitat. Born, living and dying in a remote provincial city which he never once left more than a day's stage journey; knowing almost nothing of the great world by personal observation; leading the simplest, most regular and monotonous of all lives; a man with little physique, five feet tall; delicate in health, hygienically fussing, often almost hypochondriac, doctoring himself; strongly averse to the clergy as a class, never having entered a church during his mature years, despite the pious heritage of his mother, who died when he was thirteen; hardly less hostile to doctors whom he distrusted and still more so to lawyers; a bachelor and an insistent censor of woman and her ways, of whom, if all his sayings were gathered and coordinated, they would almost make a fourth critique; not even speaking to his own two sisters who were domestics, for twenty years, one of whom nursed him in his last days of most distressing decrepitude; never having seen an art gallery; of humble origin, the son of a strapmaker, and

poor all his life till his wretchedly paid professorship at the age of 46 did give him the means of living comfortably with great economy; knowing almost nothing of science, save physics and mathematics together with a little geography and a gossipy anthropology, on all of which he lectured before he turned to philosophy; mostly ignorant of Greek and caring little for music, save that of the military bands in his garrison city which the young soldiers whom he lectured much liked; idolized during his later life; formal, methodic; loving the companionship of his inferiors, and excessively deferential to his superiors as seen in his often fulsome dedications, rather the fashion of his day; inept with men of the world; amazingly ignorant as has been abundantly shown of the history of philosophy, even that just preceding his own day;—he rather naturally became the embodiment of criticism, which was the very spirit of his age by which he was caught up, for it was a day when reason was the academic as in the days of the French Revolution it had been made the popular goddess. Kant might almost be called the leading representative and the mouthpiece of the *éclaircissement* of his day. Every institution and every type of culture and belief were being subjected to revision and criticism, but reason meant deductive logic and science meant physics and mathematics, while philosophy meant metaphysics. Kant knew the world only intellectually and through the medium of books and he saw it only in the dry light of intellect. For his *Gemüth* or emotionality, life was almost undeveloped, save in and from few directions and in these but slightly, and his academic seclusion was almost isolation from the world of action. His deeds, which Carlyle says are the only actions of complete men, consist in thinking in his study with his eyes almost hypnotically focused upon the distant church spire, so that he was upset when it was hidden by the twigs of a growing tree, or upon the brass button of one of his students which had to be restored before he was able to lecture well again. He was old when he was young in years and what little youth he ever experienced was in the form of a certain limited mellowness and second childhood as he grew old. Senescence was hard on him and his faculties decayed, one eye even growing blind twenty years before his death at the age of eighty. He had become petulant, physically emaciated, a quaint little mannikin, pestered by trifles, positively worried over the attentions his great fame had given him and over his letters. Yet he was comfortable to the end and his extreme and rigid economy revealed to the amaze-

ment of every one an estate of nearly \$16,000 and a library of 500 volumes.

To conclude, Kantianism is one of the antique cumbersome systems of regarding the world that belong only to the museums of the history of philosophy. It is not a scheme for our time and to install its antiquated gearing in eager and youthful minds very greatly reduces their efficiency for the world's work to-day. Its thought machinery is wasteful, very ponderous and requires immense mind power to run it. To change the trope, it is like an old battle ship that did good service in its day, but should be drydocked, because afloat it is a derelict and a menace and no one who knows what a modern warship is and can do would think of embarking in it, but would be content to visit and inspect it as a curious relic of bygone days. A few of its timbers are marvelously sound and can be built into new constructions, but as it stands in Hartenstein's eight volumes, it is utterly unseaworthy. Kant restated many of the eternal verities of religion in terms that made them more efficient for the culture of his day, so that he marked a distinct stage of advance. Modern pragmatism is stating the same old truths in a still more effective way which approximates still further towards the scientific standpoint. But even pragmatism, which decants this old wine of meaning into still newer bottles, makes them more appetizing to the scientific palate and should be heartily welcomed as a further step towards closing the chasm between religion and science, while it has immense significance and amounts indeed to a new dispensation for the old speculative philosophies, has no significance whatever for science to which it has nothing to tell, to give or teach, for from the very start, science has been through and through pragmatic. Indeed, the most advanced pragmatism is only a dilution of scientific principles with speculative and religious tinctures. It is simply a fresh step in the auto-therapy of culture illustrating the *vis curatrix animi*. For science, it still contains some of the old virus of alienation. From direct, close, immediate intuition of facts and things it directs observation not to nature but to the process by which we know it. It involves introversion or introspection of activities that should not be subjected to consciousness, which interferes with their perfect operation; it is like the anxious examination of the patient's own heart, stomach, liver, eyes, etc., the subjectivization of which is impossible and unnatural with perfect circulation and digestion. Pragmatism is at best then a movement which lies entirely within

the field of epistemology, which is itself of only limited and qualified value, but this new movement is one towards its sanification in that it is a little less tainted with hypochondria. True science has always been and must forever be pragmatic, but is liable to be injured if it becomes conscious even of this fact. Pragmatism has reduced the percentage of inefficiency of both subjective and absolute idealism, but is itself much below the standard of efficiency set by science. It is simply the philosophy of pedagogy transfigured, glorified and given a new name, taught by new disciples. It sets forth the rationale of adjustment to nascent stages and recognizes that even cultivated adults are only children of larger growth. Like pedagogy, it is genetic rather than logical, but science in its higher modern sense, including the study of all that is in physical nature, in man, religion, etc., both requires and illustrates a higher standardization and a greater efficiency. We may thus safely conclude that from this point of view, it is high time that the present widespread academic cult of Kant and his successors in academic institutions be greatly reduced, since the excessive cult of this method is not only wasteful of the best thing life has to give—youth and enthusiasm—but is pernicious.

PROLEGOMENA TO A STUDY OF INTROSPECTION

By E. B. TITCHENER

We are not likely to remark, in any but a vague and general way, a change in which we are essentially concerned; *tempora mutantur, nos et mutamur in illis*. Yet those who remember the psychological laboratories of twenty years ago can hardly escape an occasional shock of contrast which, for the moment, throws into vivid relief the difference between the old order and the new. The experimenter of the early nineties trusted, first of all, in his instruments; chronoscope and kymograph and tachistoscope were—it is hardly an exaggeration to say—of more importance than the observer; and the observer had nothing more difficult to do than to analyse a chord, or to report the ‘fluctuation of attention,’ or to trace schematically the course of successive association. There were still vast reaches of the mental life which experiment had not touched; we believed, at least the enthusiasts among us, that the method would some day carry us to them; meanwhile, certain chapters of psychology were written rather in the light of ‘system’ than by the aid of fact. Now, twenty years after, we have changed all that. The movement towards qualitative analysis has culminated in what is called, with a certain redundancy of expression, the method of ‘systematic experimental introspection.’ Our graduate students—far better trained, it is true, than we were in our generation—sit down cheerfully to introspective tasks such as we had not dreamed of. And it is when some second-year graduate brings in a sheaf of reports upon Understanding or Belief, upon Recognition or Judgment, that the director of a laboratory has his historic sense aroused, and wonders what he, at the same age, could have made of a similar problem.

But if the individual is thus disposed to take for granted the development of the science, it is true, on the other hand, that his indifference is offset by a kind of self-consciousness on the part of the science itself. A great change has taken place, intensively and extensively, in the conduct of the introspective method; and with this practical change there has

grown up, naturally and as it were instinctively, a tendency to discuss the method, to trace its application, to classify the errors to which it is exposed, to set forth its scope and its limitations. What we knew about introspection, twenty years ago, is very fairly summed up in such a book as Sully's *Human Mind*.¹ To-day, if we are still far from agreement and from perfect comprehension, we have at least progressed beyond the stage of generalities to that of monographic detail. And our interest in method is evidenced on all hands: within the space of a year there have appeared Müller's special study of introspection in the field of memory,² and the more general articles by Anschütz,³ Dugas,⁴ de Sanctis⁵ and Dodge.^{6a}

In this and the following articles I shall be concerned with various phases of the introspective method, and with certain questions that are suggested by its use. I begin, in the present paper, with brief comment upon a number of special points. The treatment makes no pretence to be adequate, though it is, I hope, less scrappy in fact than it is in appearance. At all events, the following paragraphs express a single attitude toward psychology; and I deemed it unwise to attempt a description of the introspective method until I had defined, in this preliminary way, my position upon various controverted questions.

1. *The Status praesens*

It is worth while, at the outset, to define the standing of introspection as psychological method; and to this end we must know the opinions of the leading psychologists of our time. Let us take them country by country.

Stumpf affirms that experimental psychology is "in the main nothing else than a method for inciting, systematically and with objective control of conditions, to introspection."⁶ Lipps declares that "the method

¹ J. Sully, *The Human Mind, a Text-book of Psychology*, i., 1892, 14 ff.

² G. E. Müller, *Zur Analyse der Gedächtnistätigkeit und des Vorstellungsverlaufes*, i., 1911, 61 ff.

³ G. Anschütz, Ueber die Methoden der Psychologie, *Arch. f. d. ges. Psych.*, xx, 1911, 414 ff.

⁴ L. Dugas, L'introspection, *Revue philos.*, lxxii, 1911, 606 ff.

⁵ S. de Sanctis, I metodi della psicologia moderna, *Rivista di Psicologia*, viii., 1912, no. 1; reprinted in *Contributi psicologici del laboratorio di psicologia sperimentale della r. Università di Roma*, i., 1910-1911.

^{6a} R. Dodge, The Theory and Limitations of Introspection, this JOURNAL, xxiii, 1912, 214 ff.

⁶ C. Stumpf, *Erscheinungen und Funktionen*, 1907, 25 note.

(Weg) of psychology is first, last and everywhere the method of direct observation of the facts; . . . and this again is primarily introspection."⁷ Wundt writes, in the same spirit: "The supreme advantage of the experimental method lies in the fact that it and it alone renders a reliable introspection possible, and that it therefore increases our ability to deal introspectively with processes not directly accessible to modification from without."⁸ Müller, in his special context, tells us that "the scientific study of memory, if it is to be complete, cannot dispense with introspection," and that his own results "rest in large measure upon the use of the subjective method;"⁹ and Anschütz, taking a more general survey of the field, characterises introspection as the "direct, primary, fundamental or essential method" of psychology.¹⁰ Has Germany need of further witnesses? I will call only on Möbius: "Empirical psychology can be nothing else than introspection elaborated by reflection."¹¹

"The first and indispensable source of knowledge of mental facts is the introspection of these facts by the individual who experiences them;"¹² "the foundation of psychological investigation is experience of the psychical facts; . . . this direct apprehension is usually termed introspection."¹³ So speak Austrian psychologists.

"Introspection," says Binet, "is the basis of psychology; it characterises psychology in so precise a way that every study which is made by introspection deserves to be called psychological, while every study which is made by another method belongs to some other science."¹⁴ Ribot, despite his championship of objective methods, is not far behind: "The method of introspection . . . is the fundamental method of psychology, the necessary condition of all the others. . . . The aptitude for introspection is not given to everyone; some possess it in high degree; these are the born psychologists."¹⁵ And Dugas concludes his critical study in like terms: "Introspection is the fundamental, original and peculiar method of psychology."¹⁶

From France I turn to Italy. "The professional psychologists of our day," remarks Villa, "are agreed that introspection is the necessary and indispensable point of departure for any examination of psychical facts." De Sanctis describes the general methods of psychology as "introspection, actual or implied, in its two forms of auto-introspection and heterointrospection, confirmed and controlled by comparative external observation and by experiment." Introspection, he continues, is "the fundamental though not the exclusive method in psychology;" "all those who aim to be psychologists must, wherever possible, invoke the testimony of the observer's consciousness, or, if this appeal is ruled out by the nature of the procedure adopted,

⁷ T. Lipps, *Leitfaden der Psychologie*, 1906, 42.

⁸ W. Wundt, *Grundzüge der physiol. Psychologie*, i., 1908, 7.

⁹ *Op. cit.*, 63.

¹⁰ *Op. cit.*, 448.

¹¹ P. J. Möbius, *Die Hoffnungslosigkeit aller Psychologie*, 1907, 13.

¹² A. Höfler, *Psychologie*, 1897, 7.

¹³ S. Witasek, *Grundlinien der Psychologie*, 1908, 92 f.

¹⁴ A. Binet, *Introduction à la psychologie expérimentale*, 1894, 18.

¹⁵ T. Ribot, in *De la méthode dans les sciences*, 1909, 230 f.

¹⁶ *Op. cit.*, 625.

must be able logically to supply that testimony, and must be governed accordingly in the drawing of psychological conclusions."¹⁷

Psychological method receives but scanty treatment in Ward's *Psychology*. We have, however, the following definite statement: "Psychology may be individualistic without being confined exclusively to the introspective method. There is nothing to hinder the psychologist from employing the materials furnished by his observations of other men, of infants, of the lower animals, or of the insane; nothing to hinder him taking counsel with the philologist or even the physiologist, provided always he can show the psychological bearings of those facts which are not directly psychological."¹⁸ Stout echoes and amplifies this doctrine as follows: "The psychologist has at his command a vast mass of data which are not due to introspection. . . . Thus we might have a kind of psychology without introspection, and yet quite distinct from physiology. What introspection does is to supply us with a direct instead of a hypothetical knowledge of mental process. It thus forms a source of psychological material which is invaluable and unattainable by any other means."¹⁹ McDougall writes that "psychology finds itself compelled in an ever-increasing degree to recognise the co-operation in all mental process of factors that are unconscious and so cannot be introspectively observed; and though some of these may be inferred from the nature of the processes revealed by introspection, others can only be inferred from the study of movements and other bodily changes." Yet we read, in another place: "The physiological psychologist must avoid the error . . . of neglecting or despising the refinements and subtleties of the introspective psychologists. He must admit the primacy of introspective psychology, must recognise that all the objective methods of psychological study presuppose the results of the subjective or introspective method and can only be fruitful in so far as they are based upon an accurate introspective analysis of mental processes."²⁰ Myers, finally, lays it down as "a golden rule that introspection should never be omitted in a psychological experiment. . . . The dangers of directly deducing the mental state of an individual from observation of his behavior cannot be too strongly emphasised."²¹

James speaks emphatically: "Introspective observation is what we have to rely on first and foremost and always."²² Ladd writes more cautiously of introspection itself; but he adds that "the method of indirect observation is inevitably connected with, and dependent upon, the method of introspection;" so that, for better or for worse, this direct method is the one reliance of psychology.²³ "The whole work of our

¹⁷ G. Villa, La question des methodes en psychologie, *Rev. scientifique*, quatrième série, t. xiv., 22 Sept. 1900, 357 col. 1; cf. 359 col. 2, 362 col. 1 *sub fin.* See also the same author's *Contemporary Psychology*, 1903, 152, 164; ch. iv. must be read with caution, since the word Introspection carries different meanings. S. de Sanctis. *op. cit.*, 9, 14, 15.

¹⁸ J. Ward, Psychology, in *Encyc. Britannica*, xxii. 1911, 548; cf. 599. G. F. Stout, *A Manual of Psychology*, 1907, 16.

¹⁹ W. McDougall, *Physiological Psychology*, 1905, 2, 12 f.

²⁰ C. S. Myers, *A Text-book of Experimental Psychology*, i, 1911, 4.

²¹ W. James, *Principles of Psychology*, i, 1890, 185.

²² G. T. Ladd, *Psychology, Descriptive and Explanatory*, 1894, 14 ff., 20. Cf. G. T. Ladd and R. S. Woodworth, *Elements of Physiological Psychology*, 1911, 5: "It is only by the method of introspection that the actual and present facts of human consciousness can be reached."

modern psychophysical laboratories," says Münsterberg, "must be characterised as essentially introspection, but introspection under artificial conditions."²² Hall strikes a dissentient note. "Formerly everyone supposed that self-observation, or looking in upon our own psychic processes, or the intensification of self-consciousness, was the oracle and muse of philosophic studies. Now, however, . . . it is coming to be seen that this method gives us access to but a very small part of the soul, as, like an iceberg, nine-tenths of which is submerged under water and only one-tenth is visible above the surface of the sea, in the same way unconscious and instinctive forces now seem to be dominant in human life, . . . and these can be studied only objectively by natural-history methods. We can reach this more comprehensive knowledge only by carefully recording descriptions of what we see in others."²³ This position is found in some recent text-books,²⁴ and appears also to be that of Dodge: "Introspection is only one of the indicators of mental reality. It is a real and important indicator, of peculiar value in special fields, but it is only one of many."²⁵

I think that these quotations are representative, both of the science of psychology and of the authors quoted. If we may take them as representative, the following conclusions emerge:

(1) It is maintained that, were introspection impossible, we might still have a science of 'psychology,' a system of observations and inferences which could not be subsumed to any existing science. This assertion cannot, so far as I see, logically be gainsaid, though one may doubt whether in fact the 'psychology' would have arisen. The issue, however, does not seem to be worth debating.

(2) It is maintained that, for the description of the subject-matter of psychology, 'objective' as well as 'subjective' methods are necessary or valuable; in other words, that certain psychological facts must or may be obtained otherwise than (directly or indirectly) by way of introspection. I believe that this position, too, is logically defensible; but I am not sure that any psychological facts can be identified as facts obtained by objective methods.

By 'psychological facts' I do not mean 'facts which are of value to the system of psychology,' but—since we are talking of method—'facts got by psychologising.' The rigorous distinction of psychology, psychophysics and physiology has been called pedantic. I am sure, however, that the terms, strictly used, stand for three different attitudes toward experience, for three different forms of scientific interrogatory, and that

²² H. Münsterberg, *Psychology and Life*, 1899, 124.

²³ G. S. Hall, A Children's Institute, *Harper's Monthly Magazine*, cxx, 1910, 621.

²⁴ C. H. Judd, *Psychology: General Introduction*, 1907, 7; E. L. Thorndike, *The Elements of Psychology*, 1905, 321; perhaps, too, W. B. Pillsbury, *The Essentials of Psychology*, 1911, 6 f. It is not always easy to interpret the brief statement of method found in text-books.

²⁵ *Op. cit.*, 229.

to-run them together indistinguishably is not to escape pedantry, but is rather to lapse from clear thinking.^{2a}

I see, now, no logical reason why we should not, as things are, add to our knowledge, for instance, of the psychological nature of emotion by strictly objective observation. But I find no clear evidence of such attainment of psychological knowledge; the facts and uniformities due to objective observation appear to be, in every case, psychophysical or physiological. Perhaps some of those who habitually psychologise by objective methods may be induced, by this statement, to give an explicit account of their procedure and its results; discussion will be profitable in proportion as it deals with particulars. On the other hand, I find upon psychological facts which purport to be derived objectively an evident, sometimes a flagrantly evident, coloring of empathy or of introspective analogy. I therefore agree with Angell that "observation of others often makes us sensitive to psychological processes in ourselves which we should otherwise overlook," but that this is in practice the limit of its application.² The logical possibility of an 'objective' enrichment of psychology remains.

^{2a} I suppose that, in theory, the number of the sciences is indefinitely large; that there may be as many different sciences as there are discriminable cognitive attitudes to the empirical universe. In practice, however, the number will always be finite; the limitations of human interest, the pressure of practical needs, the narrow range of attainable fact, these and many other influences will always be at work to direct and restrict the scientific activity of an epoch. The sciences that we find established, or in course of establishment, thus correspond to cognitive attitudes which have received some sort of sanction from the *Zeitgeist*. Certain of these attitudes are still gross, and will presently be differentiated; others perhaps are mistakenly distinguished, and will presently be identified, or at least brought into relation. Meanwhile, the investigator follows his problem,—in the light of all the knowledge that he can obtain, and in any direction that seems to lead toward solution. He may, in his pursuit, take up many diverse attitudes; and who that knows the difficulty of constructive work in science will say him nay? Only it is well that he should change his attitude, not blindly and confusedly, but with realisation; that he should always, as we say, be 'sure of his ground'; that he should not ignore the methodology of his time, but should test and, if possible, improve it; and that, if he removes distinctions, he should transcend and synthesise rather than just obliterate.—

I add this Note after reading the Symposium on the Relations of Psychology and Medical Education published in the *Journ. Amer. Med. Assn.*, lviii., 1912, 909 ff. And I may end it by quoting the Baconian maxim: quod omnes scientiarum partitiones ita intelligantur et adhibeantur, ut scientias potius signent aut distinguant, quam secent et divellant.

² J. R. Angell, *Psychology*, 1904, 5. The terms 'objective' and 'subjective' are, perhaps, open to misunderstanding; for in one—and that a very important—sense the domain of introspection is no less 'objective' to psychology than is the field of external observation to physics or to biology. "The really objective method in psychology," says Lipps (*op. cit.*, 47), "is the observation of one's own conscious life. Without this, every method is subjective, i. e., is a method of arbitrary interpretation and of confirmation of preconceived opinions." In the present connection, 'subjective' means introspective, and 'objective' means non-introspective; I take the words as I find them, without prejudice to a future definition.

(3) It is maintained that introspection is the one distinctively psychological method, and that all objective data must, if they are to become psychological, be interpreted in the light of introspection. This position seems to represent our actual practice in psychology, and to possess a logical warrant at least as strong as that of its rival.²⁸

Finally, if we consider the quoted passages from another point of view, we may conclude that

(4) The method of introspection, despite all attacks made upon it, is regarded by the great majority of present-day psychologists as the most important means of psychological knowledge; and that

(5) The method attacked and the method upheld are, in some instances, methods of an entirely different character; the term introspection is equivocal.

2. *Gross Differences in the Meaning of 'Introspection'*

(1) There is still need to distinguish the introspection of the psychological laboratory from the introspection of a moralising common-sense. For novelists and essayists are still ready to declare that the exercise of the introspective method is unwholesome; they speak of a morbid introspection; they advise us to eschew it, not to become preoccupied with our inner experience. The classical warning is that of Kant, who cautions his readers against keeping a diary of their thoughts and feelings; that way, he says, lie extravagance, distortion of perspective, perhaps madness itself.²⁹ I remember that, even in my own time at Leipsic, the student of experimental psychology was told, half in jest but fully half in earnest, that he ran the risk of the insane asylum. And within this twentieth century the reviewer of one of my books gravely doubts the after-effect upon character of certain prescribed experiments; dangerous possibilities are involved, risks to nerves; some curiosities are only to be gratified at too great a cost!

This misunderstanding hinges, of course, upon the meaning given to self-observation. Introspection, let us admit, is self-observation. And if by that we mean, as popular psychology means, a study of mind not for its sake but for ours; an

²⁸ It is the position taken, among writers of recent text-books, by M. W. Calkins, *A First Book in Psychology*, 1910, 6; R. M. Yerkes, *Introduction to Psychology*, 1911, 39. As regards logic, Wundt declares roundly (*Philos. Studien*, iv, 1888, 304): "Eine derartige Methode [eine Methode die bloss objektiv wäre, d. h. die Selbstbeobachtung ausschliesse] für die Psychologie verlangen, hiesse meines Erachtens eine Sinnlosigkeit verlangen."

²⁹ I. Kant, *Anthropologie in pragmatischer Hinsicht*, 1798, 11.

appraisal of our mental possessions; an absorption, anxious or complacent, in the strength of our intellect. the delicacy of our sentiments, the firmness of our resolution: then certainly self-observation is morbid and egotistical; we are living in a world of fictitious values. But if self-observation means, simply, psychological observation; and if observation in psychology has as its end a knowledge of mind, and not the glorifying or humiliation of the observer: then, just as certainly, introspection may be as impersonal, as objective, as matter-of-fact, as is the observation of the natural sciences. The psychologist observes himself, not because he thinks he is especially admirable, nor because he feels a peculiar need to keep watch over his inner life; in these respects he stands on the same level with all the rest of the world, and behaves as any other, non-psychological individual may* behave; he observes himself, because his mind is the only mind directly accessible to him, and mind is the topic of his professional interest.

(2) More important, however, is the distinction of the critical and the precritical use of introspection. The precritical method has been roundly condemned by Comte, Lange and Maudsley. "We have no place," cries Comte, "we have no place, under any pretext, for this illusory psychology which is the final transformation of theology . . . This pretended psychological method is null and void in its very essence and conception . . . For two thousand years the metaphysicians have been cultivating psychology by its aid; and they cannot yet agree upon a single proposition that is intelligible and solidly established. . . . Introspection gives rise to almost as many divergent opinions as there are individuals who rely upon it."³⁰ Lange writes in like vein: "It would be quite useless to offer a prize to anyone who should hunt out a single real observation in the two thick volumes [of Fortlage's *System*]. . . . The boasted system of self-observation seems to be so much liked precisely because of its defects. For even though, as Kant feared, enthusiasm and hallucination are not in its train, yet it will always continue a means of lending to the most fanciful imaginations of metaphysic the appearance of empirical deduction."³¹ And Maudsley complains that "there is no agreement between those who have acquired the power of introspection; and men of apparently equal cultivation and capacity will, with the utmost sincerity and confi-

³⁰ A. Comte, *Cours de philosophie positive*, i, 1830, 34 ff.

³¹ F. A. Lange, *History of Materialism* (tr. E. C. Thomas), iii, 1892, 171 ff.

dence, lay down inconsistent or directly contradictory propositions. . . . There is no witness who is so easily suborned to give false evidence, and whose testimony at all times requires such stringent cross-examination, as self-consciousness."³²

The truth contained in these criticisms may, I think, be summed up in two propositions, which at the same time bring out the narrowness of the critical attitude. There is a great deal of error in the introspection of the precritical, pre-experimental period; but the error is due to the fact that the introspection was not a direct observation, but essentially a reflective interpretation in terms of some philosophical system.³³ There is, on the other hand, a great deal of true observation mixed in with the interpretation (Wundt has a good word to say even for Fortlage;³⁴ and Möbius points out that the oldest psychological achievement, the naming of our inner states, is also the greatest);³⁵ but the psychologists of a pre-critical, pre-comparative, pre-experimental day were at a woeful disadvantage; they had no criterion of general validity; they had no means of distinguishing the universal from the particular, or the objectively observed from the construc-

³² H. Maudsley, *The Physiology of Mind*, 1876, 16 f. Yet the same author writes in the same book (47) that the results of introspection "must, in the hands of competent men, be as useful as they are indispensable." Who is to judge of competence, if "there is no agreement between those who have acquired the power of introspection?" And how can a method be indispensable, if "it is of little value, because it has reference only to a small part of that for which its testimony is invoked" (18 f.)?

³³ Wundt has dealt faithfully with this phase of the question in various publications: e. g., *Beiträge zur Theorie der Sinneswahrnehmung*, 1862, Einleitung, xvi, ff.; *Selbstbeobachtung und innere Wahrnehmung*, *Philos. Studien*, iv, 1888, 292 ff.; *Die Aufgaben der experimentellen Psychologie*, *Essays*, 1906, 196 ff.; *Logik*, iii, 1908, 163 ff.; *Grundsätze der physiol. Psychologie*, i, 1908, 6, 419. Müller (*op. cit.*, 147) sketches the procedure as follows: "If one compares the hopeless sterility of these philosophical expositions with the overwhelming abundance of interesting and important facts that introspection has brought to light in the field of memory since the advent of experimental psychology, one is forced to conclude: the much vaunted introspective method of the philosophers was, in essentials, nothing else than the method of 'putative recollection.' The philosopher, who in all probability means to dispose of the doctrine of memory in a few days or even in a few hours, sits down to write, and tries by the aid of recollection to give an account of the regular course of the operations of memory in his own experience. The results obtained accord with the method employed."

³⁴ *Philos. Studien*, iv, 1888, 297: ". . . diesem Psychologen, bei dem sich manche feine und gute Bemerkungen finden . . . ;" *ct. Grunds. d. physiol. Psychol.*, i, 1908, 6.

³⁵ *Op. cit.*, 13.

tively rationalised. Rightly to appreciate the method of the older psychology, then, one has to compare it with the Aristotelian physics, or with Schelling's and Hegel's philosophy of nature; one has to think of such books as Grotius' *De jure belli et pacis* or, at a lower level, as Browne's *Pseudodoxia epidemica*. The reader of these works, coming to them in the critical attitude of the nineteenth century, wonders that men of such grasp, such sanity, such learning, could also have been so warped, so trivial, so inconsequent, so lacking in perspective. There is no harm in the wonder; that may be the first step towards understanding. But our trio of critics pass straight from wonder to exaggeration; and then, having exaggerated, they condemn.

3. *Contradictory Results from Scientific Introspection*

Current introspection—the conduct of which I propose to discuss in another paper—is, therefore, to be distinguished from the introspection either of a moralising common-sense or of a rationalising philosophy. But current introspection, however safeguarded, does not itself bring us, in every case, to uniformity of result. I have referred elsewhere to a well-known instance.³⁸ Mach and Stumpf sat down together before a harmonium, in the physical laboratory at Prague, to decide the question whether attention to one of the component tones of an ordinary musical chord does or does not strengthen that particular tone. Mach declared that the intensification was quite clear; Stumpf could find no trace of intensive change. A like divergence, on a larger scale, has resulted from recent studies of the processes of thought; some observers find, while others as definitely fail to find, a non-imaginal element of thought. What is the value of a method which lands us in difficulties of this sort?

Those who see in this question the last word of destructive criticism may be reminded that no scientific method is infallible. Not long ago there was much talk about the *n*-rays; there has been a good deal of dispute about the electrically positive or negative character of certain radioactive phenomena; and there are still, I believe, astronomers who look sceptically upon the Flagstaff maps of the Martian canals. The difference between Mach and Stumpf is, after all, no more radical than the difference between two histologists, the one of whom reads anastomosis and the other mechanical apposition from the preparation before him. And the difference between, say, Bühler and Angell is no more radical

³⁸ *Feeling and Attention*, 1908, 215 f.

than that between two physiologists the one of whom holds a myogenic, the other a neurogenic theory of the heart-beat. Psychology is not the only science in which the strict application of the best available method leads to opposite conclusions.⁸⁷

But is there the same hope, in psychology, that the differences will presently be resolved? I see no reason for any but an affirmative answer. Repeated observations have shown me, *e.g.*, that Mach's result is often due to a confusion of tonal intensity with tonal clearness or vividness; let this confusion be cleared up, and an observer who has judged as Mach will now judge as Stumpf. Here, then, is a possible—and a very simple—explanation of the discrepancy. Should it prove, on trial, that Mach is free of this confusion, we are by no means at the end of our introspective tether: it may be that expectant attention gives rise, in his mind, to an intensive image, a sort of hallucination of the expected tone; such cases are known; and if the suggestion were verified, we could accept Stumpf's hypothesis of individual difference. But let both these explanations fail,—still there is no reason to despair: a more methodical series of observations, with variation of conditions, would either bring the two observers into agreement or would give us the key to their disagreement.

The question of the thought-element is more complicated; and its answer must come by way of a progressive refinement of method and a progressive differentiation of points of attack. No one will deny that the method of 'systematic experimental introspection' has furthered the psychology of thought and volition; no one, I imagine, supposes that the method has attained—has even approximated—its definitive form. It will probably emerge from its time of trial as a number of specific procedures, each one addressed to some specific aspect of the problem, and all alike safeguarded against preventible error; in other words, as a group of typical methods, comparable perhaps with the metric methods of psychophysics. The refinement and the differentiation will, however, need time and the cooperative labour of many minds.

⁸⁷ Here is a pretty illustration: *Nature* for Oct. 1, 1908, prints side by side two physiological addresses; *The Relation of Physiology to Physics and Chemistry*, by J. S. Haldane, and *The Manifestations of the Principles of Chemical Mechanics in the Living Plant*, by F. F. Blackman (lxxviii, 553,556). The writers' conclusions are as different as they could well be. But if physiology flourishes in defiance of such division against itself, psychology need not be concerned at a controversy regarding the thought-processes.

A scientific movement should be judged at its best, and not at its worst: what should we think of the Freudian doctrines if we knew only the extravagances of their popular statement and the superficialities of some of their champions? Crude work has been done, no doubt, in the name of experimental introspection; crude work is done by the unskilled in every department of science. "Some of the studies in which introspection has been pushed farthest"—so a recent critic tells us³³—"seem to approach the limit of uncritical procedure:" the meaning is that certain studies in which the writer has professed an exclusive or predominating reliance upon introspection are thus uncritical. I heartily agree. But in all fairness two remarks should be added: that work as uncritical has been done with professed reliance upon objective experimentation; and that 'some of the studies in which introspection has been pushed farthest' are ensamples of critical caution.

A criticism that constantly recurs, not in psychology only but in all the sciences, is the charge of preconception, of bias, on the part of the observer. "More than once it has been pointed out that the individual's answer to the question [of imageless thought] depends largely on the school in which he was trained. . . . At the heart of the matter I believe the real problem is not whether a given observer always finds sensory factors in the analysis of all his mental experience, but how any observer with the usual training could avoid finding them, whether they were necessary parts of that experience or not."³⁴ It seems to me that the criticism, as thus formulated, fails to hold the balance between two necessary but opposed factors in scientific progress, and that it is, accordingly, both unjust in temper and mistaken in fact. We have to recognise, on the one hand, that scientific advance, whether critical or constructive, is impossible apart from theoretical preconception. "How can a man have a critical judgment in scientific questions," asks Wundt, "and at the same time be impartial?"³⁵ And how, we might add, can a man put any question to mind or to nature without showing, in the very wording of his question, that he has been influenced by theory?³⁶ On the other hand, the history of science proves conclusively that a particular preconception, even though it is stamped with the highest scientific authority, and even though it may be fatal to the individual, is not a permanent bar to progress. Sooner or later, observations made in a given theoretical interest will be seen not to fit the theory; sooner or

³³ R. Dodge, *op. cit.*, 214 f.

³⁴ *Ibid.*, 223; cf. R. M. Ogden, *Psychol. Bulletin*, viii, 1911, 330 f.

³⁵ Ueber empirische und metaphysische Psychologie. *Arch. f. d. ges. Psych.*, ii, 1904, 334.

³⁶ A brilliant defence of unguided observation is offered by H. H. Turner. The Characteristics of the Observational Sciences. *Nature*, lxxxvii, 1911, 289 ff. "The perception of the need for observations, the faith that something will come of them, and the skill and energy to act on that faith—these qualities . . . have at least as much to do with the advance of Science as the formulation of a theory, even of a correct theory" (290). I should reply that the 'faith' and the 'perception of a need' represent a certain form of what I have called theoretical preconception; they constitute a bias, a guiding motive. It is not necessary that the observer take sides for or against a special theory: the point is that his observations are selective, and not made wholly at random.

later, observers 'with the usual training' will strike out new theories of their own.⁴²

The criticism, then, fails to hold the balance between the necessity of a theoretical setting for observation and the investigator's readiness to correct or to change his theory in the light of observation. If it were valid, men of like training would always think alike, the pupil would never break away from the master, and the course of scientific advance would illustrate the preformational view of evolution. If it were valid, criticism would always be immanent, confirming or attacking from within the logical structure of a system, and the conflicts of nativism and empiricism, voluntarism and intellectualism, and their like, would be unknown.⁴³

4. *Introspection and Self-consciousness*

There is, of course, a sense in which the introspecting psychologist may be termed 'self'-conscious; he is observing 'his own mind,' the only mind directly accessible to him. And if nothing more were meant by the term self-observation, or by the statement that introspection is an interrogation of self-consciousness, no objection could be raised. But self-observation and self-consciousness are terms with many meanings. It is consequently difficult, at times, to know just what a writer intends by their use; and it is easy to misinterpret, even to caricature a perfectly harmless statement. I have no wish to

⁴² An instance is given by Turner, *op. cit.*, 202. Instructive in the same connection is A. Schuster, *The Progress of Physics during Thirty-three Years*, 1908.

Müller (*op. cit.*, 159) has a relevant passage. "The trained and experienced psychologist knows how often a really experimental study of the mental processes which appear under determinate conditions has led to the recognition that these processes have a different character, or take a different course, from that which had earlier been assumed on the ground of certain general preconceptions. He knows how often, in experiments which he has carried out himself, the course of the mental processes has been radically different from that which he had previously imagined; how often, in cases in which, as he thought, all the possibilities were familiar to him, the actual course of the experiments has shown that there was still another possibility, of which he had not the slightest inkling. Thus it was formerly thought self-evident that, in the comparison of two successive impressions, the perception of the second stimulus was always accompanied by a memory image of the first; though this view of the mechanism of comparison leads and led to a number of consequences which are often enough contradicted by experience."

⁴³ Anschütz (*op. cit.*, 491) deals with this matter as follows: "That experiment is for the most part simply a means of confirming preconceived opinions is an assertion which, while it may be true in occasional instances, can be maintained only by those who have themselves made as yet no serious experiment, and who assuredly have not experienced the very fruitful suggestion that even the most acute of *a priori* thinkers may derive from it." I may perhaps be allowed to refer also to my *Feeling and Attention*, 48, 198, 293 f.

exaggerate, and therefore I shall in this section be sparing with references; but I wish to be clear, and therefore I shall risk the charge of exaggeration.

I have the impression, then, that certain psychologists, in writing of self-observation, think of the 'mind' as in some way 'turning in upon itself,' very much as one might fancifully conceive of the eyes as turning about to view the brain; that this mental gymnastic appeals to them as something far more difficult of performance than the direction of the mind to the outer world; and that they are thus led to regard self-observation as the mind's crowning achievement, the signal difference between man and the lower animals. Mind, in some fashion, consciously makes itself its own object; gets out of itself, and then turns round to examine the self which it has left. I have the impression, further, that the self-consciousness which is thought by these psychologists to be involved in introspection is understood *im prägnanten Sinne*; that the psychological observer is supposed to be aware of himself as introspecting himself, aware of himself as observer and aware of himself as observed, while at the same time he is aware of the relation of the two selves, of the observing attitude which the one assumes to the other. If I am mistaken, so much the better; my account may still stand as a possible interpretation of loose speech, and as a warning against carelessness of statement.

For, as a matter of fact, introspection knows nothing of this sort of mind or self and its performances. Introspection is an interrogation of experience; as such, it issues either from a present conscious purpose or from a habit of observation which is the resultant of previous conscious purpose; and, in so far, it is the expression of 'reflection' or of 'reflective thought.' In so far, but no farther: it implies self-consciousness only in the sense and to the degree in which all scientific observation, that of physics and chemistry included, implies self-consciousness. Mental development must have reached a certain level before science is at all possible; but when science has become possible, the conditions are given for a psychology as well as for a physics and a physiology; the data of matter, of life and of mind are observable in essentially the same way. The older psychologies, however explicit as regards the difficulties and dangers of introspection, never describe the actual conduct of the method; nor could they if they had tried; for introspection on the schema which their authors imagined for it is a logical absurdity. But traditions are long in dying, and authority plays its part even in science—

with the result, in this present connection, that the sections on Method in a great many modern books are still sadly inadequate to the facts upon which the exposition of psychology is grounded.

In illustration of the views which I am here criticising, I will quote first a passage from Ward. "Not only is it not the same thing to feel and to know that you feel; but it might even be held to be a different thing still to know that you feel and to know that you know that you feel—such being the difference perhaps between ordinary reflection and psychological introspection."⁴⁴ The passage is expanded by Stout as follows: "The most important drawback [to introspection] is that the mind in watching its own workings must necessarily have its attention divided between two objects,—on the one hand, the mental operation itself which is to be observed, and on the other, the object to which this mental operation is directed. If I observe the process of seeing, I must attend at once to what is seen, and to the seeing of it. If I observe what takes place in attending, I must first attend to something, and then to the process of attention."⁴⁵ Subtleties of this sort perplex the student unnecessarily: though a few introspective exercises, under the conditions of the laboratory, may be relied upon to dispel the perplexity.

I refer, secondly, to a well-known passage in James' *Principles*. "It is very difficult, introspectively, to see the transitive parts for what they really are. . . . The attempt at introspective analysis in these cases is in fact like seizing a spinning top to catch its motion, or trying to turn up the gas quick enough to see how the darkness looks. And the challenge to produce these psychoses . . . is as unfair as Zeno's treatment of the advocates of motion . . ." But for the picturesqueness of the style, the sentences might have come from Maudsley.⁴⁶ It is only fair to add that James has previously given us an admirable account of introspection; that he is here writing in polemical vein; and that his later exposition shows how we may indeed 'produce' the psychoses in question without thereby annihilating them.

Finally, I mention the doctrine of introspection that Dürr sets forth in his continuation of Ebbinghaus' *Psychologie*. Our consciousness of time, Dürr thinks, can be accounted for only if we postulate 'acts of primary recollection,' in which we apprehend the 'just past' character of conscious contents: in which, that is, we are aware that a certain sensation was present a moment ago, that a certain idea just now cropped up, that a certain feeling was just now aroused.⁴⁷ These acts of recollection are 'produced acts of self-consciousness;' in other words, they are acts of self-consciousness that are directly dependent upon, or are immediately touched off by, such experiences as are fitted to serve as their vehicle or ground; they are not 'reproduced,' but stand to their conscious conditions in the relation which feeling bears to its con-

⁴⁴ *Op. cit.*, 599. The passage occurs also in the earlier form of the article.

⁴⁵ *Op. cit.*, 18. E. Rabier (*Leçons de philosophie*, i, 1896, 35) makes the 'drawback' an impossibility; "attention," he says, "is indivisible."

⁴⁶ *Op. cit.*, i, 243 f.

⁴⁷ *Op. cit.*, 17 (c). Maudsley himself gets the objection from Comte.

⁴⁸ H. Ebbinghaus u. E. Dürr, *Grundsätze d. Psychol.*, i, 1911, 503; ii, 1911, 221. The term 'act' is technical, corresponding to what Stumpf calls *Funktion* (i, 3).

ditioning sensation, or a melody to its conditioning tones.⁴⁹ Grant their existence, and the problem of introspection receives an 'excessively simple' solution: introspection is nothing else than "an enhancement of the conscious status of the acts of self-consciousness which are productively aroused by every experience."⁵⁰ Simplicity has its acknowledged charms; but, in this particular case, I must say with Marbe: "Diese Ansicht ist mir keineswegs geläufig."⁵¹

I have referred, purposely, to writers of unquestioned merit. If they are infected with the virus of self-consciousness, in the sense of this section, we may assume the same infection in psychologists of weaker constitution. To go further into detail would be to anticipate the topic of my next paper.

5. *Is Introspection Necessarily a Conscious Process?*

It is often said that introspection is itself a conscious process, and that therefore psychological observation must—by the introduction of this new conscious process—interfere with the consciousness which it aims to observe. The objection, again, takes us back to Kant: "psychological observation by its very nature alters and distorts the state of the observed object."⁵² Kant was not an enthusiast on the subject of psychology.

We might, now, meet the objection on its own ground. Grant that the act of observing is an experience of the same kind as the experience that you wish to observe; and grant that its introduction must accordingly alter the total consciousness in which that experience is set. Still, the act of observing would, after practice, after it had become a habit, be essentially the same in all observations; the change that it made in consciousness would therefore be a definite, constant change,—a change which you might not be able to estimate or describe, but which you could rely upon to remain the same, in kind and in degree, for all sorts of consciousnesses. The result of psychological observation would thus be subject to error, but to what is technically known as a constant error; and there is nothing fatal to science in that; what science fears is the variable error, an error that changes from one observation to another, or from moment to moment of the same continued observation.⁵³

⁴⁹ *Ibid.*, i, 444 f.

⁵⁰ *Ibid.*, ii, 221: "Eine Steigerung des Bewusstseitsgrades der Akte des Selbstbewusstseins, die von jedem Erlebnis produktiv angeregt werden."

⁵¹ K. Marbe, review of E. Dürr, *Erkenntnistheorie*, *Zeits. f. Psychol.*, lx, 1911, 115, 121.

⁵² I. Kant, *Metaphysische Anfangsgründe der Naturwissenschaft*, 1786, x. f. Cf. J. B. Meyer, *Kant's Psychology*, 1870, 207 ff.

⁵³ I do not here discuss the more usual reply to the objection,—the reply that introspection is, in strictness, retrospection.

It is, however, needless thus to face a difficulty until one is sure that the difficulty exists. What are the facts about introspection, as the method is employed in current experimental work? Is introspection necessarily a conscious process?

Long before the days of the *Aufgabe*-psychology, Wundt had answered this question in the negative. Wundt, it will be remembered, affirms that experiment not only safeguards introspection, but actually makes introspection, as a scientific method, possible.⁵⁴ Here, then, is his reply to Kant. "The objection overlooks the enormous influence exerted, in these as in all observations, by the mechanism of habit, by the practice which results from the frequent repetition of similar observations. *In his attention to the phenomena under observation*, the observer in psychology, no less than the observer in physics, *completely forgets to give subjective attention to the state of observing*. So long as this state is felt to be unnatural and itself incites to reflection, so long, of course, observations in both sciences are unreliable; and it is therefore obvious that, in both fields, the special subjective art of experimental observation, as well as the external technical procedure, must be learned and practised."⁵⁵ Nowadays, of course, we should supplement this account by a reference to the 'purpose' to introspect and its gradual lapse from a psychophysical to a physiological status.⁵⁶ But our reply to the general question would be the same: introspection, in the ordinary course of psychological investigation, is not as such a conscious process.

We have, in fact, but very scanty knowledge of the experiences in which introspection as a conscious process does take part. The introspective exercises set to the beginner, in laboratory drill-courses, are of an extremely simple kind; and the *bona fide* beginner does not bother about the 'state of observing.' The only cases of such concern that I remember, from all my years of teaching, were furnished by relatively mature students of philosophy who, for one reason or another, desired an elementary laboratory training, and who brought to their work a sophisticated interest. Nothing can be made of such students until the teacher has won their goodwill; and when that has been gained, they are ready to follow instructions, and to forget themselves in the experiment. On the other hand, the reports of research-work usually pass over, with mere mention, the preliminary experiments of the period of practice; the observers, as we know them, are already trained; the 'state of observing' has already been mechanised.

We have, it is true, a number of recorded instances in which intro-

⁵⁴ E. g., *Phil. Studien*, iv, 1888, 303; cf. note 8, above.

⁵⁵ W. Wundt, *Logik*, ii, 2, 1895, 175 f. Italics are mine.

⁵⁶ I have discussed, in my *Thought-processes*, the effect of a 'purpose to introspect' and the more general question of the lapse of the *Aufgabe* from consciousness. Müller's detailed study of the *Selbstbeobachtungsabsicht* (*op. cit.*, 72 ff.) will be reviewed in another paper.

spection 'during the course of the observation' has interfered with an experiment. Usually, however, the interference is due, not to the irruption into consciousness of introspection itself, but simply to the premature arrest of the observation at some point which has surprised or interested the observer, or to which his attention has been directed by the phrasing of the instruction. Ach tells us of observers who, from misunderstanding of instruction in the simple reaction experiment, concentrated upon the strain-sensations of the fore-period, and thus, to all intents, broke off the experiment in what should have been its initial stage."⁷ More to the point, perhaps, is another remark of Ach's. "Observer H was led, by the questions put to him, to observe his attitude (*Verhalten*) on the apperception of the stimulus in the main-period; he was thereby thrown into a state of confusion, which influenced unfavorably the further course of the process."⁸ If 'attitude' here means 'state of observing' we have, in this case, the appearance of introspection as a conscious process, though we are not informed as to its nature or composition. Such cases, Ach says, were rare.

I had thought that light might be thrown upon introspection, as an occasionally conscious process, by the recent studies of the acquisition of motor skill, in which the process of learning is set forth from its beginning. If, however, these studies contain relevant observations, I have unfortunately missed them. Book, for instance, writes: "A well-known difficulty encountered in getting reliable introspective data is to keep consciousness from concerning itself with the observing act. This was met in the present experiment by having each learner take care always to write at a maximum rate and without thinking of how the work was done or of how attention was working."⁹

6. *Non-introspective Characterisations of Mind*

It is a fact obvious enough, but sometimes lost sight of, that a characterisation of mind need not, just because it characterises a 'mental state,' therefore be introspective. Introspection approaches mind from the special standpoint of descriptive psychology. But mind is approached from many other standpoints: from that of moralising common-sense, from that of philosophical reflection, from that of biology, from that of everyday converse. In strictness, no one of these standpoints is capable of furnishing introspective data: introspection demands, if systematic, the carefully planned observations and the trained observers of the psychological laboratory and, if casual, an ingrained habit of observation that has been moulded in the laboratory.¹⁰

I am aware, of course, that the non-introspective attitudes

⁷ N Ach, *Ueber die Willenstätigkeit und das Denken*, 1905, 37; cf. *Thought-processes*, 238 f. Cases of this sort are, I imagine, familiar to all investigators of the 'higher' intellectual processes.

⁸ *Ibid.*, 22. Cf. Müller, *op. cit.*, 74.

⁹ W. F. Book, *The Psychology of Skill, with Special Reference to its Acquisition in Typewriting*, 1908, 17.

¹⁰ I do not forget the questionnaire and the mass-experiment. But these, to be of value, must be very simple exercises in introspection, planned and tested by the trained psychologist. And I doubt if, at the best, their value is more than confirmatory. Cf. Müller, *op. cit.*, 146.

to mind do, oftentimes, furnish suggestion, and even material, that may be of high value to the descriptive psychologist. There are two reasons: that they are attitudes familiar to the psychologist in his own experience, and therefore comparable or interchangeable with the other attitude, of introspection; and that their determination, as traditional or historical attitudes, may be of a mixed or, to speak more accurately, of an undifferentiated nature, and may therefore contain the primule of what, at a later stage of development, is a truly psychological 'set.' But these facts do not affect the general statement.

I quote once more from Stout. "There is no fallacy, obscurity or ambiguity in the statement that when I have toothache I dislike it very much, or that I was afraid when I saw a white figure in the churchyard. There is no fallacy or ambiguity in the statement that feeling pleased is different from feeling displeased, or that when we are fully convinced that an action is totally impossible, we cannot voluntarily determine to perform it. Facts of this kind can be observed with ease and certainty by everyone. Now if introspection could only supply us with such simple and obvious data, it would none the less be of essential value. It would supply us with the general terms in which to describe mental process."⁶¹ I cannot imagine anybody but a professional psychologist declaring that 'feeling pleased is different from feeling displeased.' As for the other instances: I can well imagine a man's saying "The one pain I can't stand is toothache," or "I must confess that I am still afraid of ghosts,"—and I can well imagine a prolonged argument on the question whether one can ever decide to do what one knows to be impossible,—without the remotest reference or the slightest appeal to introspection.

Thorndike, again, in a rough list of the 'mental facts' which form the subject-matter of psychology, mentions "ideas, opinions, memories, hopes, fears, pleasures, pains, smells, tastes, and so on."⁶² But what are 'opinions' doing in that galley? In what sense is an 'opinion' to be included in a "list of states of mind?" There is a psychology of opinion, as there is a psychology of assumption, of working hypothesis, of belief; but the opinion as opinion is not material for psychology. One wonders, indeed, whether the presence of this term will not lead the reader to misinterpret the rest. In phrases like "I acted upon the idea that he was not in earnest," "memories of a long life," "he never lost the hope of educating himself,"—in phrases like these, the words 'idea' and 'memories' and 'hope' are not psychological; and yet it is in such meanings that they go best with the word 'opinion.' For further discussion of this point, in a special case, I refer to the paper entitled *Description vs. Statement of Meaning*, published in the last number of the JOURNAL.

On the other hand, the pragmatic attitude of daily life may, on occasion, be identical with the introspective attitude of the psychologist. Müller instances the layman, suddenly made aware by a 'psychological apperception' that his visual memory-image of a colored object is itself colorless.⁶³ We all know of similar cases. A child of six once asked me how it was that, if you shut your eyes, you could see pictures of

⁶¹ *Op. cit.*, 16 f.

⁶² E. L. Thorndike, *The Elements of Psychology*, 1905, 1.

⁶³ *Op. cit.*, i, 1911, 70; cf. 105.

things that were not there. The same child at nine betrayed by a casual remark that she, and her elder sister of eleven, possessed and had discussed number-forms. A chance conversation at a dinner table brought out the fact that some of the company saw colors, and some saw only greys, in their dream scenes. Anecdotes of mental peculiarity find their way into print, and may form the starting-point of studies like Galton's enquiry into mental imagery.⁶⁴ The psychologist will, indeed, always be quick to take advantage of observations of this kind, when they come his way; he will question and compare, and may perhaps be drawn into a serious investigation. It is clear, however, that the occasional introspection is of value to psychology only if the psychologist is there to pick it up.

The training of which I have spoken, as necessary to a systematic introspection, is essentially the same as the training necessary to reliable observation in physics or biology. There is nothing mysterious or esoteric about the introspective method. If there are differences in introspective ability, so also are there differences in mathematical, musical, linguistic ability,—in theoretical and practical ability of every kind. A high degree of native ability may shorten the period of apprenticeship; but our most gifted musicians, our ablest engineers, must still be trained; and, conversely, a very slender ability may be brought, by a well-directed course of training, to very respectable performance. Introspection is a technical method, and is best learned in a technical school; like other technical methods, it is best learned while the learner is still young; it is, however, a method which any normal person, coming to the task with goodwill and application, may understand and acquire.

The undergraduate, no doubt, finds introspection difficult. When he is called upon to observe the negative after-image, or to describe his sensations of cutaneous warmth and cold, he is likely to draw an unfavorable comparison between psychology and physics; the objects of psychological observation 'can't be got hold of,' are—in his immature vocabulary—'vague' and 'abstract.' The difficulty is real; we have all suffered from the elusiveness, the intangibility, of mental processes. We seek to reassure the beginner by pointing out that elusiveness and intangibility are, after all, relative terms, and that practice will do for him what it has done for others before him. At this stage of his training we can hardly say more. In fact, however, the difficulty goes deeper: for the break with common sense is made earlier and more definitely in psychology than it is, perhaps, in any other science. The student of physics or chemistry or biology may hold, for some little time, to his common-sense attitude; the materials with which he has to deal are still, in large measure, the 'things' of everyday life: his experiments and formulas have a familiar setting. Psychology, on the other hand, enjoins a new attitude to mind; unlearning begins with learning; the laboratory offers an immediate challenge to tradition and opinion. From the pedagogical point of view, psychology is here at a disadvantage,—though it may be questioned whether the disadvantage at the start is not offset by advantage for the future; whether the student of physics or biology, when he comes to physicise or biologise the whole of experience, is not handicapped by his youthful alliance with common sense; whether the student of psychology does not gain, in the long run, by the greater severity of his early discipline. Be this as it may, the difficulty which the beginner feels is, in so far, a difficulty which he is unable to express, and which—if formulated for him—he is unable in any intimate way to understand. It should not be mini-

⁶⁴ F. Galton, *Inquiries into Human Faculty*, 1883, 83.

mised: it should not, either, be misinterpreted. Scientific method is a genus with many species; and training in the method of any one science is only specifically different from training in the method of any other.

7. *What May We Ask of Introspection?*

Introspection can never give us a system of psychology. The 'pure' psychology of the middle nineteenth-century was, as we have seen, systematised by metaphysics; and modern systems, in order to be systematic, inevitably appeal to something—to the unconscious, to the nervous system, to laws of mental growth and mental organisation—which is not discoverable by introspection. How, indeed, should a method, of itself, yield a science? Introspection is psychological observation; and observation is a way of getting facts, 'observations' in the passive sense, data, materials of science. I hope to discuss, in a later paper, the nature and the range of the facts which introspection reveals: that is a question by itself. Meanwhile, "introspection, viz., the observing and dissecting of experience, is quite like observing the things of sense; there is no more virtue in it, but also no less. It is not for introspection to make explanations, but to discern particular facts."⁶⁵

A good deal of misunderstanding is due, simply and solely, to the ambiguities of language. What, for instance, does a writer mean by 'psychological methods'? He may mean the specific methods which the psychologist, in his capacity and by his training as psychologist, employs in his psychologising: methods, therefore, which have not been acquired by the physicist and physiologist. Or he may mean methods which the systematising psychologist employs in the construction of a rounded science of psychology: methods, therefore, which—so far as they are not specifically psychological in the sense just indicated—are common to all systematisers of science. When Wundt says: "All psychology rests upon introspection,"⁶⁶ he is thinking of the former meaning of psychological method; when Ladd says: "To observation, direct and indirect, and to analysis by introspection, reflection, and experiment, we add induction as the necessary method of psychological science," and when to observation, analysis and induction he further adds the "genetic method,"⁶⁷ it is obvious, without the telling, that he has in mind the systematic presentation of mental life, the psychological treatise. What, again, is meant

⁶⁵ W. Mitchell, *Structure and Growth of the Mind*, 1907, 423. Cf. my *Text-book of Psychol.*, 1910, 38 ff.

⁶⁶ W. Wundt, *Logik*, ii, 2, 1895, 170.

⁶⁷ G. T. Ladd, *Psychology, Descriptive and Explanatory*, 1894, 24 f.

by 'introspective psychology'? The words may mean 'a system of psychology which contains (or consists of) only what is furnished by introspection,'—that is, they may be interpreted to make nonsense. Or they may mean 'a system of psychology in which introspection is regarded as the sole, peculiarly psychological method'; in this sense they cover such a system as is set forth in Wundt's *Physiologische Psychologie* and *Völkerpsychologie*,—cover, for that matter, practically all our current systems. Or again they may mean 'psychology in so far as it is introspective,' 'that body of psychological materials which is furnished by introspection,' and thus may carry no reference at all to a psychological system. But suppose that the phrase is used in this third sense, and is read in the first: then a misunderstanding has arisen, from purely verbal suggestion, before there has been opportunity for mutual explanation.

The limits of introspection, on the side of system-making, have often been pointed out; Möbius' discussion may be taken as typical. Dodge is, however, mistaken in his belief that Möbius teaches "the fallaciousness of all introspection and the consequent hopelessness of all empirical psychology."¹⁰ Möbius does not underestimate the difficulties of introspection; but he nowhere calls it fallacious. Psychology is hopeless because "the psychologist has absolutely nothing more than introspection and the argument from analogy;" and as these are inadequate to a science, "psychology must cross the borderline of empiricism and reach a hand to metaphysics."¹¹ I agree with Möbius and Dodge that introspection cannot make a science; I agree with Dodge, and disagree with Möbius, in thinking that we can achieve a science of empirical psychology.

Summary.—The method of introspection is still generally regarded as the most important means of psychological knowledge. The introspection of the laboratory must, however, be distinguished from that either of a moralising common sense or of a rationalising philosophy. In its scientific form the method is its own test: contradictory results mean an imperfect control of the conditions of observation.

Introspection implies self-consciousness only in the sense and to the degree in which all scientific observation implies self-consciousness. And its employment need not be conscious; for time and experience reduce it to a habit.

Introspection presupposes a particular scientific standpoint, that of descriptive psychology. It is not, however, adequate of itself to furnish a psychological system; like other scientific methods, it supplies materials which, by the aid of explanatory principles, may be worked up into a system.

¹⁰ *Op. cit.*, 214.

¹¹ *Op. cit.*, 13, 14, 51 f., 68.

DESCRIPTION OF A ROTARY CAMPIMETER

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The object of this apparatus is to add to the vertical campimeter the rotary features of the perimeter, and thus to allow investigation of every possible meridian of the retina with as much ease and precision as was possible with the old form of campimeter in the nasal meridian only, or at most, in the nasal and temporal meridians. The apparatus consists of two parts, with appropriate supports and accessories; a stimulus screen, and a campimeter screen which rotates on a collar around a circular support. The stimulus is exposed through an opening in the center of the campimeter screen. One arm of the framework of this screen carries the fixation-points and also a right-angled extension which allows fixation to be given at an eccentricity of 92° . This arm may be rotated to any position desired; and thus any meridian of the retina may be explored. In order that the sensation received in the peripheral retina may be accurately expressed in terms of color- and brightness-values of the central retina, the fixation-arm of the screen is further provided with a small detachable motor upon which may be rotated the proper combination of discs for matching the peripheral sensation. This increases greatly the definiteness of work on the sensitivity of the peripheral retina. The feature was added to the apparatus so that complete maps might be made of the changes in the sensitivity of the retina from center to periphery and from one meridian to another, with tables showing the value of the changes from point to point.

Photographs of the skeleton apparatus and of the front and back views of the campimeter, in readiness for use, are appended.

Figure 1 shows the skeleton apparatus. It consists of the following parts: Supporting base, frame for campimeter screen, and frame for the stimulus card. The supporting base consists of a horizontal steel bar, 83 cm. long, supported by two iron tripod rests (B and B'). To this bar are clamped two uprights (C and C'), which are adjustable along its length. The anterior upright (C) supports the frame on which the background of cardboard and the campimeter screen (D) are fastened. The posterior upright (C') supports the stimulus frame (E). The height from

the table of each of these frameworks is adjustable by means of set-screws (F and F'). The framework for the campimeter screen consists of a central support and radiating arms. The central support consists of a stationary brass ring, about which rotates a larger brass collar (H), 20 cm. in diameter.¹

The back surface of collar (H) is graduated from 0° to 360° . To this collar are fastened the radiating arms. There are eight of these arms, one for each 45° mark of the graduated collar. They are made of steel and are 2 cm. broad and 40 cm. long. The eighth arm (I and I') differs from the other seven. It forms a right angle, one side of which lies in the plane of the background, and the other in front of this plane. The part in the plane of the background is 30 cm. long, and the part at right angles to this plane is 28 cm. long. The arm is graduated from 18° to 57° along the section that lies in the plane of the background and from 57° to 92° along the section at right angles. The graduations are based on the arc of a circle of 25 cm. radius. The arm is also split lengthwise to form two narrow arms, each 1 cm. wide, so separated that there is an opening (J) 0.8 cm. in width between them to admit the shank of the motor for rotating the discs needed to match the peripheral sensation. The opening to admit the shank of the motor may be clearly seen in all the pictures of the campimeter. The motor is shown at K, on the right of Figure 1, and more clearly on the left of Figure 3. It has a shank 4 cm. long, and 0.3 cm. in diameter, which can readily be thrust through the opening (J). The weight of the motor is so great that it can not be clamped to the arm (I-I') and be shifted with the arm as the retina is tested in different meridians. It has then to be supported so that it can readily and quickly be moved to any point in any meridian to which the arm (I-I') may be rotated. This is accomplished by the use of two rods—one vertical and the other horizontal (M). The vertical rod (L) may be clamped to the table

¹ This ring was made large in diameter for two reasons. (a) The ring had to be made very thick in order to give sufficient rigidity to support the campimeter screen and to furnish proper attachment for the rotary collar. Had the circumference been small, the effect of the ring would have been that of a short tube. If the stimulus were viewed through a short tube, an induction factor would have been involved which would have been difficult, if not impossible, to standardize. The opening in the ring was, therefore, made considerably larger than any stimulus we wished to use in order to avoid the introduction of this factor. (b) The large circumference of the ring makes the apparatus available for investigating the effect upon sensitivity of varying the size of the stimulus.

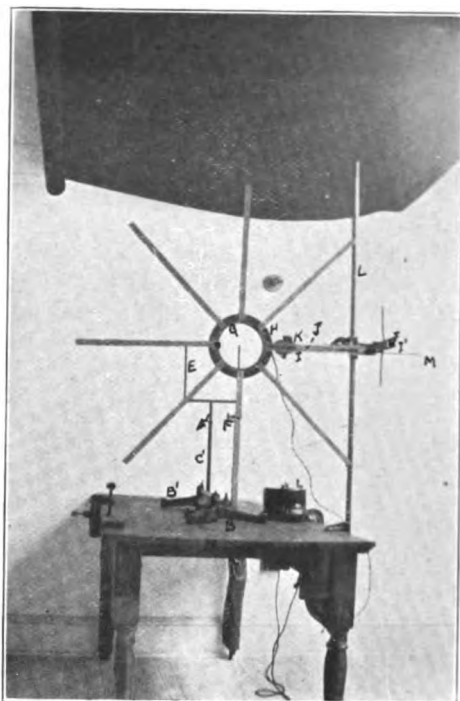


FIG. I.

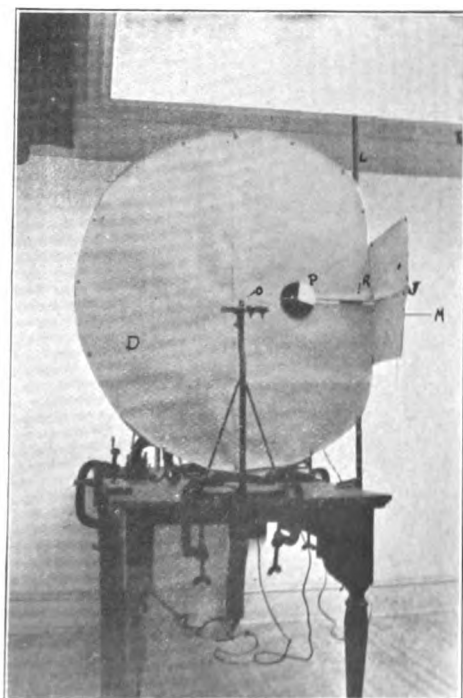


FIG. II.

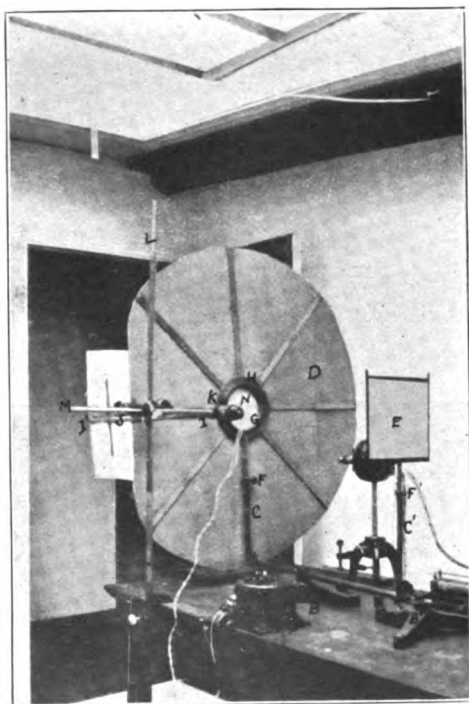


FIG. III.

or other support on either side of the campimeter, and M is clamped to L. The vertical adjustment for any setting of the motor can thus be made along L, and the horizontal adjustment along M. Holes are punched in each of the eight arms at six or more places to allow the insertion of small metal fasteners to hold the background screen to the frame. The stimulus frame may be seen at E. It is 20 cm. square and carries a groove for the insertion of the stimulus card. The stimulus card may be made of whatever colored paper the experimenter desires to use.

Figure 2 shows the front view of the campimeter in readiness for use, and Figure 3, the back view. A card-board background has been fastened to the steel arms by means of paper fasteners. Since the background is fastened to the arms attached to the brass collar (H), a circular gap is left at its center. This gap is filled by a disc (N), shown in Figure 3, which has been fastened to the arms just outside of the collar (H). The disc is 27 cm. in diameter, and contains the stimulus opening (O), the size of which may be varied to accord with the purpose of the investigation. In order to complete the graduations on the fixation-arm to the stimulus opening, disc (N) is graduated from 0° to 18° . A background 40 cm. in height is fastened to the extension arm (I). In the picture a paper screen made of No. 7 of the Hering series of grays has been attached by thumb tacks to the card-board background.² A strip of paper of the same quality as the background is placed along the opening (J), and the graduations from 0° to 92° are pricked on this strip at points determined by the markings on the back of disc (N) and arm (I-I'). These constitute the fixation points. The card in the stimulus frame (E) is seen through the opening (O). A disc (P) composed of black and white sectors has been placed on the motor (K).

The method of using this apparatus is as follows: The observer is seated in front of the campimeter-screen with his head held in a rigid position by means of a mouth-board bearing the impression of the teeth in sealing wax. Since the graduations of the fixation-arm are based on the arc of a circle of 25 cm. radius, the distance of the eye from the stimulus opening is chosen as 25 cm. The position

² In all tests of the relative and absolute sensitivity of the retina this screen should be made of a gray of the brightness of the color to be used. No departure from this rule should be permitted unless it is for the purpose of determining the effect of different screens on the sensitivity of the retina, or of using this effect as a means of varying sensitivity.

of the eye in the observing plane may be obtained according to the method described by Fernald.* In order to facilitate eccentric fixation in the nasal and temporal meridians, the head should be turned 45° nasalwards or temporalwards, as the case may be. With the head so placed, the eye can swing easily from the stimulus opening to a fixation-point whose eccentricity exceeds 90° . The unused eye is closed and covered by a bandage. The arm (I-I') is placed in the meridian desired, the position being determined by the graduations on the collar (H). The experimenter covers the stimulus in the stimulus frame with a card, which we shall call the pre-exposure card,[†] while the observer takes the fixation required. At a signal given by the observer, the pre-exposure card is withdrawn, the stimulus is exposed for three seconds, and the pre-exposure card is replaced over the stimulus. The observer is required to rest the eye after each observation. Further provisions against fatigue are made by periods of rest after each fifteen minutes of observation.

When it is desired to measure the stimulus as seen in the peripheral retina in terms of the brightness- and color-values of the central retina, the motor shown at K in Figures 1 and 3 is used. The method of making the measurement is as follows: If a direct vision judgment, for example, of the appearance of yellow at 25° in the temporal meridian is wanted, the cord (R) carrying a movable fixation-point, seen in Figure 2, is fastened in front of the 25° point on the graduated background. The observer, in position, fixates the 25° point and brings the movable point in line with the eye and the 25° point. This point then serves as the new fixation-point, and the graduated strip covering the opening (J) is removed. The required discs are placed on the motor immediately behind the new fixation-point, and their proportions are changed until the observer judges that the sensation aroused in the periphery is matched by that aroused in the center by the measuring-disc on the motor. In making this judgment, the method of ascending and descending series should be used.

This apparatus was designed two years ago. The object at that time was, in general, to make an exhaustive study of retinal sensitivity to colored light in a large number of

* FERNALD, G. M.: The Effect of Achromatic Conditions on the Color Phenomena of Peripheral Vision. *Psychol. Rev., Monograph Supplements*, X, 1909, p. 18.

[†] In all investigations of relative or absolute sensitivity, this pre-exposure card also should be made of a gray of the brightness of the color to be used.

meridians. Early in this work, however, the need for more adequate standardization was recognized. The problem of standardizing was divided into two parts: the source of light, and the factors extraneous to the source of light. The apparatus described above was designed especially for the standardization of the factors extraneous to the source of light. Pigment papers were used in this work as a source of light because they are fully adequate to the needs of the problem, and are besides much more convenient than spectral light for many of its details. The apparatus was thus especially devised for the use of pigment papers. About nine months ago, however, the standardization of the source of light was begun. This required, on the qualitative side, that light of spectral purity be used; and on the quantitative side, that the lights be measured in terms of units that can be compared, i. e., in terms of energy or radiometric units. The apparatus has been remodeled and supplemented to meet these needs. A description of the revised apparatus together with the supplement for radiometric measurements will be given in a later paper.

A REMARK ON THE LEGIBILITY OF PRINTED TYPES

By F. M. URBAN

Miss B. E. Roethlein published in the January number of this JOURNAL an account of a very interesting investigation on the relative legibility of different faces of printing types. At the end of the paper she discusses the influence of the quality and texture of paper, and mentions the suggestion of Babbage that slightly yellowish paper be used in the manufacturing of books. She remarks that, from the data available in the literature, it is impossible to decide whether this suggestion is of real value or not.

It does not seem that this idea was intended for ordinary books which are read in the customary way, but for reference books only which, like tables of logarithms, must be consulted a great many times and where the information required must be picked out from a great number of similar data. It seems that Babbage's idea has stood the test of experience and is now past the experimental stage. The geographical survey of the French army (*Service géographique de l'armée*) publishes logarithm tables which make use of Babbage's suggestion. All these tables are printed on colored paper which is absolutely dull, so as to avoid the glare of reflected light. The tables which are most frequently used are printed on slightly yellowish paper; and only the tables of the trigonometric functions in the hexagesimal division of the circle are printed on blue paper, in order to make these tables easily recognizable. The success of this plan is indisputable. The first edition of the tables with five places was soon exhausted; a new edition had to be issued in 1906, which except for the elimination of a few misprints is an exact reproduction of the first.

These tables are superior in many respects to the ordinary tables, so that one cannot attribute their success to any particular feature. The fact, however, that the colored paper is used in both editions suggests that this innovation has proved to be useful. Anybody who is sufficiently interested can easily verify the superiority of the tables of the French survey by the following experiment. Use these tables the first evening for from two to three hours, and on the following evening repeat the calculations with any other logarithm table. The mental strain and the fatigue of the eyes will be considerably greater in the second case. I called the attention of several of my friends to these tables and they all agreed as to their superiority—a testimonial which found its realistic expression in the purchase of a copy of the book by those who have to use logarithms a good deal.

I should like to call the attention of the experimentalists to the fact that numerical tables offer several interesting psychological problems. I will mention in this place only some of the more obvious ones. The ordinary table of logarithms contains ten numbers on each line; and from this group of ten numbers one has to choose the right one.

This process is not a simple one, because the eye has difficulty in following the line accurately. Most people aid the eye by indicating this movement with the finger and stopping at the right place. The above mentioned tables of the French survey eliminate this difficulty by printing the logarithms directly alongside the corresponding numbers. This makes the tables somewhat longer; but it facilitates the work of the computer in a very high degree.

It seems that this difficulty of keeping the eye on the same line depends on two factors, the amount of space between the lines and the number of lines which are grouped together. The ordinary tables group the lines in sets of ten,—the groups being separated either by a wider space or by a bar. Groups of ten are entirely too large and it seems advisable to split them up into groups of three lines separated by wider spaces, and to put the tenth line between two solid black bars. This is, for instance, the arrangement of Bruns's table of the probability integral. While working with these tables one need not use one's finger to indicate the correct entry; and mistakes are very rare. The increase in the size of the tables is inconsiderable, amounting to only a few lines per page.

It ought to be possible to get some experimental material showing the best arrangement for tables of this kind. This could very well be done with an apparatus similar to the one employed by Miss Roethlein, adapted in such a way as to investigate the influence of the spacing of the same type. Mistakes are rare if the lines are very far apart; but they seem to become more frequent with decrease of the space between the lines. It is, therefore, a legitimate question to ask, what is the minimal space between the lines which is compatible with accurate reading. Such results might save unnecessary expense in printing; and—what is perhaps more important—they would save time and energy in computing. Numerical calculations are carried on all over the world on an ever-increasing scale; and any slight saving of time has a very definite value in dollars and cents.

Another important point to consider is the amount of fatigue produced by different types and by different spacings. The energy and the eyesight of the calculator are assets which must not be trifled with. The compilers of many of the logarithm tables which are on the market apparently did not take this fact into consideration at all. The figures are printed on glossy paper as close together as possible, thereby producing on the eye a most disagreeable effect.

These questions have to do with a problem in optics, which can be approached by straightforward methods. My next observation refers to the psychology of memory. In selecting logarithms from a table, or in consulting any other numerical table, one has to remember the figures while putting them down on paper. My observation is that I can take in five or six figures almost at a glance, and remember them accurately for the short time necessary to write them down. It requires a decided effort for me to read a seven-place logarithm at a single glance; and in copying any number which contains more than seven figures I usually divide it into groups of convenient size. This certainly is not entirely due to lack of practice on my part, because several professional computers, whom I had a chance to interview on this topic, seemed to agree that six or seven figures is just about the limit which can be taken in at once. Only one of my friends seems to be able to select a ten-place logarithm from a table at a single glance; but he is gifted with an unusually good memory, as is also shown by his achievements as a blindfolded chessplayer. It seems that this fact is intimately connected

with the problem of the *Umfang des Bewusstseins*, and might be investigated by the same methods which have been employed in that topic.

My next and last observation refers to a much more complicated psychological problem and is directly suggested by the above-mentioned French tables. It is customary to divide the circle into quadrants of ninety degrees each,—a custom which we inherit from the Babylonians, if one may believe our historians. This hexagesimal system has many inconveniences due to the fact that it does not use our decimal system of numbers. In order to avoid them, Delambre divided the right angle in 100 degrees and calculated tables of the trigonometric functions for this new division of the circle. This division is also adopted in the new tables of the *Service géographique de l'armée*; and any one may readily see from these tables that the centesimal division of the circle is by far superior to the old system. All the calculations are much simpler and afford fewer chances for mistakes.

The centesimal division of the circle is—or at least ought to be—universally known by the profession; and it is a surprising fact that the innovation has not yet received unanimous sanction. It certainly is just as simple to teach that the right angle contains one hundred degrees as that it contains ninety degrees. There are no material interests at stake, because the instruments for measuring angles may still be used so long as they are accurate, since it is an easy matter to transform the old readings into the new system. One involuntarily thinks of the obstacles which the introduction of the metric system has encountered, although the case is slightly different here. People naturally cling to customs and institutions which they regard as characteristic of their country; and a change in the system of weights and measures necessitates a certain initial outlay which is perhaps not quite inconsiderable. No such reasons can be urged against the introduction of the new division of the circle; but it seems that every new idea has to overcome a certain resistance before its true value is recognised. The arguments brought forward in defense of the old system are very likely of small intrinsic value; but they are certainly of interest to the psychologist, and their study would make an interesting chapter of *Völkerversychologie*.

A LIST OF THE WRITINGS OF JAMES WARD

By. E. B. TITCHENER and W. S. FOSTER

For aid in the preparation of this bibliography we are indebted, in the first instance, to Professor Ward himself; without his assistance we should have sinned grievously, both by omission and by commission. Our thanks are also due to Dr. L. N. Wilson, Librarian of Clark University, and to Professor R. M. Yerkes of Harvard University.

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- (1) *Animal Locomotion*. Nature, ix., 381-2, March 29, 1874.
- (2) *Animal Locomotion*. Nature, ix., 440, April 9, 1874.

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- (1) *An Attempt to Interpret Fechner's Law*. Mind, [O. S.] i., 452-466. (Part of a privately published Fellowship Dissertation, written in 1875.)

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- (1) *Observations on the Physiology of the Nervous System of the Crayfish*. Proceedings of the Royal Society of London, xxviii., no. 194, March 6, 1879, 379-383. Communicated by M. Foster. Received Feb. 17, 1879. (Summary of the following paper.)
- (2) *Some Notes on the Physiology of the Nervous System of the Freshwater Crayfish* (*Astacus fluviatilis*). Journal of Physiology, ii., 214-227.
- (3) *Vitality of the Common Snail*. Nature, xx., 363, August 14, 1879.

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- (1) *Herbart*. Encyclopaedia Britannica, 9th ed., xi., 718-720.
- (2) *Ueber die Auslösung von Reflexbewegungen durch eine Summe schwacher Reize*. Archiv f. [Anatomie u.] Physiologie, Jahrgang 1880, 72-91.
- (3) *Mental Culture*. Opening address of the session 1880-81 delivered before the Men and Women's College, London. Journal of Education, N. S. ii., 277-281. [Republished in *Essays, Mock Essays and Character Sketches*, reprinted from the Journal of Education, New York, Whittaker & Co., n. d., 72-98.]

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- (3) *Objects and their Interaction.* Journal of Speculative Philosophy, xvii., 169-179. (One-half of a privately printed paper. Other such papers discussed *Space and Time*, pp. 16; *The Law of Relativity*, pp. 8.)
- (4) *Intellectual Training.* Annual Address as President of the Educational Society. Journal of Education, N. S. v., 393-399.

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- (1) *The Progress of Philosophy.* Mind, [O. S.] xv., 213-233.
- (2) *Notes on Educational Values.* Journal of Education, N. S. xii., no. 256, Nov. 1, 1890, 627-632.

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- (1) "*Modern*" *Psychology: A Reflexion.* Mind, N. S. ii., 54-82.
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- (3) *On the Definition of Psychology*. *British Journal of Psychology*, i., 3-25.
- (4) *Philosophical Orientation and Scientific Standpoints*. Annual Public Address, Philosophical Union of the University of California, Aug. 26, 1904. *The University Chronicle* (University of California), vii., no. 1, Sept. 1904, 1-24.
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(1) *Herbart*. Encyclopaedia Britannica, 11th ed., xiii., 335-338.

(2) *Naturalism*. Encyclopaedia Britannica, 11th ed., xix., 274-275. (Unchanged from 1902, 1.)

(3) *Psychology*. Encyclopaedia Britannica, 11th ed., xxii., 547-604.

(4) Book-notice of de Tunzelmann, G. W., *A Treatise on Electrical Theory and the Problem of the Universe*, Mind, N. S. xx., 579-580.

(5) *The Realm of Ends or Pluralism and Theism: Gifford lectures delivered in the University of St. Andrews 1907-1910*. Cambridge, University Press; New York, G. P. Putnam's Sons. 8vo. pp. xv., 490.

THE DISCRIMINATION OF ARTICULATE SOUNDS BY CATS

By W. T. SHEPHERD, Ph.D.

This paper is a report of experiments which were made with cats to determine their ability to discriminate articulate sounds. If an animal forms an association between a certain name and food, so that he reacts in a definite manner to that name in order to obtain food, and does not so react when other names are called, we may say he discriminates that name from the other words. The major part of the routine work of the experiments to be reported was done by my wife, Mrs. Barbara Shepherd.

It is commonly believed that the higher mammals can be taught to respond to their names, or to express it more accurately, to discriminate articulate sounds and to make appropriate motor responses thereto. It is well known that dogs, horses and other domesticated animals learn to respond to their given names; but it is not known, from well-conducted experiments, whether there is in these cases a discrimination of quality, loudness, or of time of the sound. The results that have been obtained with animals under experimental conditions have been few, and in some cases the differentiation of tone and intensity has not been made. Thorndike, it will be remembered, found that cats were apparently able to discriminate sounds made by him, though not with a great degree of delicacy.¹ The sounds that Thorndike used were quite complex in character, such as, "I must feed those cats" and "My name is Thorndike." In his work on the functions of the temporal lobes Kalisher reported² having been able to get dogs to discriminate sounds made by an harmonium, but he was more interested in producing the association for the purpose of determining (after extirpation of different parts of the cerebral cortex) the cortical centers for sound perception than ability in his animals to discriminate sounds. Selionyi,³ using a form of the 'Pawlow method' on dogs, has also obtained evidence of discrimination by them of the tones of an organ, of organ pipes and of two whistles. He also was chiefly interested in sound discrimination from a physiological standpoint. In experiments on auditory discrimination in raccoons by the present writer in 1906, reported by Cole,⁴ evidence of pitch discrimination by those animals was obtained. In experiments on auditory discrimination in Rhesus monkeys which I made in 1909, evidence of discrimination of pitch and also of discrimination of 'noise' was obtained.⁵ In tests made by the present writer on raccoons for the discrimination of articulate sounds,⁶ similar

¹ THORNDIKE, *Animal Intelligence*, 1898, 129 ff.

² KALISHER, *Eine neue Hörprüfungsmethode bei Hunden*, *Sitz. d. Kgl. Ak. d. Wiss.* X. 1907, 204 ff.

³ SELIONYI, G. P., *Contributions to the Study of the Reactions of the Dog to Auditory Stimuli*. St. Petersburg, 1907.

⁴ COLE, *Concerning the Intelligence of Raccoons*, *Jour. Comp. Neur. and Psychol.* XVII. 236.

⁵ SHEPHERD, *Some Mental Processes of the Rhesus Monkey*, *Psychol. Rev. Mon. Sup.* No. 52, 1910, 26 ff.

⁶ SHEPHERD, *The Discrimination of Articulate Sounds by Raccoons*, *Amer. Jour. Psychol.* XXII, 1911, 116 ff.

to the tests herein presented, satisfactory evidence of such discrimination was obtained.

At the time the experiments to be reported were begun, one of the animals was seven months old. It had not been called by any especial name, and had not had any previous training in the discrimination of articulate sounds. The animal appeared to be of medium intelligence. The other cat, the mother of the first, was about three years old. The latter animal, previously to these experiments, had been given the name of Widget, and apparently responded to that name. The cat was of average intelligence. Both animals were ordinary grey house cats.

The cat was placed in a cage, 66 centimeters in height. A wire netting formed the front and also the top of the cage. The experimenter sat a distance of about a meter from the front of the cage and called the name given the animal. Ten seconds were allowed the cat, if necessary, in which to give the proper motor response, then, whether or not a response was obtained, the animal was fed. In conjunction with the name given, other words were also called, viz., 'no feed,' and when the latter words were called the cat was not fed. For the first animal the proper response was considered to be obtained if it reared up with the paws on the front of the cage and looked up for food to be given it through the top of the cage. A similar response was required of the second cat in the earlier experiments with it, while in the later ones the required response was changed, as will be hereinafter explained. The name of the animal and 'no feed' were called in an irregular order, so that the response might not be to the mere of the calling of the words. During the experiments, the cats were kept moderately hungry.

Pet. On the third day of the experiments, this animal began to show some indication of forming the association: In twenty trials it responded to the name *Pet* nine times, and in twenty trials to the 'no feed' call, it responded three times. The animal continued to improve in the association of its name with the proper reaction, and, on the ninth day, or after 150 trials in all, of 'Pet' and of 'no feed,' it responded to the name 'Pet' nineteen times in twenty trials, and to 'no feed' seven times. On the thirteenth day, or after 250 trials, the cat had perfected the association. In twenty trials it responded to its name twenty times and to 'no feed' two times. In one of its responses to 'no feed' on that day, the cat got down again at once. In four of the trials it got part way up. In both of the latter instances of errors, it appeared, by its looks, to know that it had made a mistake by so responding. Control tests were then made of the animal's ability to discriminate. In the first of these control tests other words were substituted for 'no feed,' as 'box,' 'floor,' but no difference in ability properly to react was noted. As a second control test, the words were called in varying tones of voice, in quite loud tones and in very low tones; but the percentage of proper reactions remained as in the experiments proper. As a third test, the words were called by a different person. Again the responses were strikingly characteristic of discrimination.

Mary. The older animal showed no clear indications of forming the proper association until about the tenth day of the experiments with it. On that day it responded to 'Mary' ten times and to 'no feed' six times in twenty trials. After this its progress in forming the association was slow. So slow did it appear in this regard that we attributed its slowness to the rather marked inactivity of the older animal. We

had noticed, however, that when its name was called the cat would look up at the top of the box or at the food lying at the distance of about a meter from the front of the cage. From this hint we changed the response required of this animal to constitute evidence of discrimination. We counted it sufficient indication of such discrimination if the animal looked towards the food when its name was called. Mary's improvement in properly reacting was at once marked. On the second day thereafter in twenty trials the cat gave the appropriate response fifteen times and reacted to the 'no feed' call six times. On the twenty-fifth day's experiment with this animal, it responded to the name Mary nineteen times and to 'no feed' four times. In nine days' further experiments this cat's record continued nearly similar to the twenty-fifth day's trials. The animal never entirely succeeded in inhibiting the tendency to respond to the 'no feed' signal. Similar control tests were employed as had been used in the case of the other animal. The results were approximately the same in percentages of proper reactions as in the experiments proper.

The results of these experiments are clearly positive. It does not appear possible to attribute the reactions of the cats to any other mental process than association of the names given them with the food getting, and the consequent discrimination of the names given them from the other words used. It cannot be objected that the animals received any cue from the experimenter, as we were careful to remain impassive during the trials, and not to give by looks, motions of the hands or body, any cue to the required response, or to allow any perceptible difference of attitude to be exhibited by us when the names Pet and Mary were called and when the other words were articulated. Neither can it be urged that the cats were led by the smell of the food to react to their names. The food was in exactly the same position in relation to the animals when their names were called as it was when we called the other words. Moreover, the three control tests employed in the experiments appear sufficiently to confirm the claim that the discrimination did take place. We conclude, therefore, that cats, or at least some cats, are able to discriminate articulate sounds.

It is of some interest to note that while in these experiments the younger cat formed the association in 250 trials, the older animal required 490 trials to form a similar association. Now, while from the small number of individuals tested in these experiments, we may not infer that younger cats will always, or usually, form an association more quickly than do their older congeners, the above results serve as confirmatory of the view held by many observers in this field that the younger, more active individuals, learn to form certain associations with more facility than do older animals under similar conditions.⁷ As compared to the ability of raccoons to discriminate words, as shown by results in similar experiments, the results obtained from the cats in these experiments appear roughly to correspond in rapidity of learning. While four raccoons tested took respectively 270, 375, 425 and 500 trials to perfect the association, the cats respectively took 250 and 490 trials. Here again, because of the few individuals used in these experiments, we are not warranted in drawing a safe inference as to the comparative ability of cats and of raccoons to discriminate words.

⁷ The fact that the older animal responded (apparently) to a different name before these experiments began might be a factor which would account in some degree for the different rapidity with which the two cats learned their names in these experiments.

BOOK REVIEWS

Le emozioni e la vita del subcosciente. By G. C. FERRARI. Rivista di psicologia, viii., 1912. 93-118.

In this article Ferrari advances a hypothesis which he refrains from calling a theory because of the uncertainties in the histological and physiological researches on the sympathetic nervous system. The hypothesis, briefly stated, is that the sympathetic or, more broadly, the autonomic nervous system, furnishes the physiological basis for the emotional and unconscious life, as distinguished from the cerebro-spinal system, which is the organ of conscious life. He calls attention to the fact that the introspective researches on thought processes by Marbe, Messer, Binet, Külpe and Bovet have had a beneficial effect in emphasizing the dynamic aspect of thought as opposed to the static discussions, from which we derive our diagrammatic representations, which tend to persist in psychological thinking.

In supporting this hypothesis Ferrari takes James' theory of the emotion as a point of departure. In James' theory that a perception or memory arouses diverse organic reactions as perceived by consciousness, vascular, glandular, muscular, etc., the emotion itself originates from a fact of consciousness, that is, from the cognition which the brain takes of the peripheral modifications. Binet in his last work reaffirmed this emphasis as to the peripheral character of the emotional phenomena, but he added a distinction between the emotion and the consciousness of it. Between an act of intellect and an act of emotion Binet finds a difference only of degree, which is marked by a difference in organic reactions, and for him "an emotion is a mental attitude of an indeterminate nature, in general important and violent." The perception of the organic sensations which accompany the attitude gives the consciousness of the emotion. The emotion exists as soon as the attitude arises, but becomes conscious only when the attitude is perceived. Ferrari notes James' distinction between the grosser or more primitive emotions, such as fear, anger, etc., and the subtler emotions, such as the intellectual, aesthetic, etc., which have not special significance for the conservation of life, and it is the first group which is constantly accompanied by the peripheral modifications which we call emotional expressions, which are traces of movements which in the phyletic series once had a protective value which no longer exists for us. James regards this as showing their vital importance, but Ferrari thinks another interpretation possible, namely that these mimetic expressions still have an effective value and are a direct sign of a correlation which we do not need to interpret.

If this be admitted, then a further inference is logically admissible. We know that these vital emotions are controlled by the same nervous system which controls vegetative life. Now if these manifestations of emotion persist in us, not because of any essential, eventual importance, but because their presence is an epiphenomenon, a fact consensual to the activity of the organs, it is simply necessary to admit that if those organs which exercise a protective function so important to the individual and to the species are innervated by a special nervous system,

and this system has no other functions, to it must be referred those protective functions of which the expression of the emotions is the external index. The physical modifications which constitute the phenomenology of the emotions are dependent upon innervation by fibres of the great sympathetic system, which controls the organic or vegetative life.

In following out the physiological basis of his hypothesis, Ferrari uses chiefly the work of J. N. Langley. Langley divided the autonomic nervous system into three parts, the cranio-cervical, the thoracic-lumbar, and the sacral. The thoracic-lumbar division together with the cords, rami, and thoracic and abdominal ganglia, form the sympathetic nervous system properly so-called, to which must be added the plexuses of Auerbach and Meissner as forming the enteric nervous system. The sympathetic system is thus only a part of the great autonomic system. The German authorities who base their division chiefly upon the fact that all the organs of vegetative life possess a double innervation give the name of sympathetic system only to that part of the ganglia chain of the sympathetic which is connected with the spinal medulla from the first thoracic to the fourth lumbar nerve, while the autonomic nervous system would consist, I, of the cranio-bulbar nervous fibres derived from the basal ganglia and the medulla oblongata, together with the ocular motor, facial, glosso-pharyngeal and vagus nerves, and, II, of the sacral nervous fibres which arise from the inferior lumbar and sacral medulla comprised in the pelvic nerve. In the whole body, the sympathetic system innervates the unstriated muscles of the organs of the blood vessels and the glandular organs. The sweat glands, however, muscles of the skin and head, and a part of the vascular muscles of the intestine, have an exclusively spinal innervation. Some of the autonomic structures have a double nervous supply which may be sympathetic and cranial, or sympathetic and sacral, while other autonomic structures have a single nervous supply, namely from the sympathetic system. Whenever the innervation is a double one, the action of the two systems, the autonomic and the sympathetic, is antagonistic. But there is no constant contrast between the function of the sympathetic fibres on the one hand and the cranial and sacral on the other. In the double supply the fibres from each source may have the same action or they may have a different action, and in the latter case either may be motor or either may be inhibitory. When, however, the fibres of one set arise from several nerves, there is no difference in function in the fibres from the several nerves, which according to Langley gives support to the theory that the cranial and sacral autonomic centers are distinct and developed at a different time and under different conditions.

In support of this theory many biological facts may be quoted. Bethe in experimenting on the most elementary nervous system, that of the *Medusa*, found that the organs of motility consisted in a circular ring on the margin of the umbrella, which is simply a gelatinous mass of undifferentiated protoplasm, and the tentacles. In these organs are contained very fine neuro-fibrils. Bethe found that if one of the tentacles be touched lightly with a glass rod there is a slight contraction, limited to a portion of the tentacle. If the touch is stronger the whole tentacle contracts, and with increasing force of the stimulus the contraction extends to the whole motor organism, thus showing that this simple nervous structure performs uniformly the two functions of motility and the vegetative life.

Moreover, in observations on the life of insects, and as we ascend the zoological scale, we find a dualism and somewhat later an opposi-

tion between the two nervous systems. Fabre observed the *cercer major*, a kind of wasp, prepares for the food of the larvae, which are born after the death of the parent, a large beetle which it paralyzes by its sting. Though the beetle is incapable of movement Fabre found death was only apparent, as no decomposition took place under conditions which would have favored it, and he found the reason for this in the arrangement of the nervous system into ganglia and supposed that there was greater tenacity of life in those ganglia which control the vegetative functions. Ferrari, however, thinks it more logical to suppose that the poison injected by the sting was of a selective nature, which affected only the motor fibres. Thus even as low down in the scale of life as the insects there exists a dualism of the nervous system. An additional proof of this dualism is furnished by the observations of Hirschfeld on embryos and acephalic monsters. In the human embryo the heart begins to beat before there is any general organization of the nervous system, and acephalic monsters have a well developed sympathetic system. Now under the reactions of the sympathetic or autonomic nervous system are included all the movements expressive of emotion while the brain, and consequently our consciousness would only be informed of the existence of the emotions by secondary paths when the global impression of the stimulus and its reaction arrives at the cortex. Observations on the perception of infants and the education of the feeble-minded have shown two successive grades in perception, that is, the simple impression and a preliminary synthesis of associated sensations which takes place before it arrives at the brain.

This hypothesis affords an explanation of the persistence of the mimetic traces in human beings of the emotional reactions of animals and primitive ancestors, for if these are not connected with some process which is continually taking place, their permanence is difficult to explain. If their value was merely that of witnesses to a past stage of evolution, these mimetic traces would occur only aberrantly, casually, like the so-called degenerative signs, instead of being constant and typical.

The instinctive and unreasonable attractions and repulsions which occur in animals under certain circumstances, for example, the tremor of the limbs, perspiration, etc., in horses who have to travel a path which has been crossed by wild animals, also indicates some deep-seated nervous reaction, which is most easily explained as the direct influence of the emotional stimuli upon the sympathetic nervous system. If we take into consideration the importance which these reactions have had in the evolution of different species of animals and man, it is evident that they could never have been safely entrusted to so complex an organ as the brain, which, by the very nature of its function of adapting the organism to new conditions, must have been in an unstable condition in order to render evolution progressive. Moreover, while it may be admitted that many of the internal functions may have originally been presided over by the brain and then relegated to the lower centers, it is not possible to imagine that a function of such importance as the conservation of life was at first performed by the sympathetic system, as is shown by the lower forms of life and acephalic monsters, was then assumed by the brain at some period of which we have no evolutionary traces, and then again became a function of the sympathetic system, whereas we know that this has always provided for the external manifestations of the emotional life. It therefore seems more

logical to conclude that the sympathetic system not only has the function of furnishing modes of emotional reaction but that it has always served completely as the anatomical substrate of the emotional life.

Another argument based on the emotional reactions is that every one of these reactions, the vaso-motor, glandular, visceral, etc., is based upon the muscular contractions, possibly even on contractions of unstriated muscle. This fact, besides establishing an analogy which is almost an identity, between the simple reflexes of peripheral origin of the autonomic system of Langley and those of our sense organs (for instance, the contraction of the ciliary or rectus muscles of the eye) also furnishes an explanation of the great value and importance of those traces of muscular contractions which the Germans call *Bewusstseinslagen*, now generally called attitudes by French and American psychologists. To the fact that these reactions are a muscular function their preservation has been due. It is being progressively demonstrated that the psychic elements which can find a path in the muscles for the efflux of their energy are those which have the greatest chance of survival and of making their efficacy felt in the consciousness of the individual and upon the fate of the species. A counter-proof also lies in the fact that emotional reflexes become attenuated in man in correlation with the progressive development of the cerebral cortex in which are found the centers of inhibition. That the fundamental facts of emotional life have undergone no essential changes in the course of evolution is too evident to require proofs. But without going back in the animal series for examples, it suffices to note that the same emotions exist in modern man as existed in the Homeric heroes. It is true that we no longer shriek aloud, nor rend our garments and tear our hair at the death of a dear friend, nor do we slaughter the household animals in his honor, because the intellectual sense of the ridiculous admonishes us and restrains these expressions, but the will and the tendencies exist and we feel their power even though the particular expressions are inhibited by the cerebral centers.

A proof of the duality of the two facts, emotions and consciousness of emotions, is found in those cases in which mental disease has caused paralysis of the superior synthesis of consciousness. In support of this Ferrari quotes the case described by D'Allonnes, in which a woman with melancholia, who was anaesthetic over a large portion of her body, showed all the external signs of emotion but declared that she felt none. Binet criticized D'Allonnes' interpretation of this case, claiming that a case completely anaesthetic to all emotion as one observed by Simon would have been apathetic, and maintained that in the D'Allonnes case there was a diminution of emotional consciousness so pronounced in contrast with the conservation of the gestures and words that it merely serves for an argument to insist upon the opposition between emotions and the consciousness of emotions. Ferrari thinks that his hypothesis offers further explanation of this case in that if the sympathetic system is the organ of the emotions and the cerebro-spinal system is the organ for the recognition of emotion, then all the reactions observed by D'Allonnes could take place and the emotion would be present but the patient would fail to recognize it in consequence of the lesions of the cerebro-spinal system, which existed in the case. Other cases of mental disease like progressive paralysis also offer an indirect confirmation of the hypothesis. In these cases there is a degeneration of the blood vessels, especially in the brain, which diminishes or suppresses mobility. The patients are optimistic. Could

not, asks Ferrari, this optimism be due to the rigidity of certain peripheral vascular reflexes, to the constant immobility of the conditions of their cerebral blood supply? In paranoiacs we also have illusions of greatness, but we find a difference in the manifestations of these three classes of cases, melancholiacs, progressive paralytics, and the paranoiacs. In the progressive paralytics there is no conflict between the illusions of greatness and willingness to perform even menial work, but in paranoiacs, although they will perform menial work they must always find some mental justification for it, that is, they must cultivate humbleness, set a good example, etc. Thus in the melancholiacs and paralytics there exists a species of discordance between the nervous systems of the intellectual and emotion life. In paranoiacs, on the contrary, the double personability results from dissociations in consciousness itself determined by the delirium or what provokes the delirium.

Ferrari finds further support for his hypothesis in the facts of gregariousness, both among animals and human beings, and again interest, which is a spring of attention and the controller of association and memory, he considers as the truest expression of those tendencies which do not succeed in sufficiently individualizing themselves to become conscious but determining our emotional disposition, modify and regulate our conduct and give it a form which our intelligence must then justify. It is this intimate and active connection between emotions, obscure, because not yet interpreted to the brain, its principal natural substrate in the nervous system, and the spirit and form of our subconscious activity, which leads Ferrari to maintain that the unconscious activity itself finds its natural foundation in the sympathetic system, which seems peculiarly fitted to be the basis of the unconscious life. It also furnishes an explanation of habit more satisfactory than those usually propounded.

Modern psychotherapy especially in its form of psychoanalysis lays great stress on those residues of impressions which the organism has received and imaged in an epoch in which they could not enter and make a part of the consciousness of the individual because the consciousness of its cerebral centers was still immature, and this also accords well with the hypothesis. Ferrari thinks that while this hypothesis will find its principal confirmation and application in clinical studies upon maladies of the sympathetic, psychology is also able to contribute to its verification.

THEODATE L. SMITH.

Friedrich Nietzsche and his New Gospel. By EMILY S. HAMBLIN.
Boston, R. G. Badger, 1911. 195 p.

This book aims to give an outline of Nietzsche's constructive thought, and to show that this thought is founded on demonstrable biological principles. It finds the essence of Nietzscheism to lie in that absolute monism which applies the law of the conscious process to all the phenomena of life. To admit the truth of this method is to recognize psychology as the "Queen of the Sciences." By this new psychology, the past and its values must be transvalued. History, philosophy and religion, are looked at from this point of view. Nietzsche's social philosophy and his psychology of woman are shown to be inspired by it. The complete symbolic expression of his thought as given in *Thus spake Zarathustra* is touched upon in the last three chapters, entitled respectively, *Zarathustra*, *Beyond-Man*, and *Eternal Recurrence*.

R. R. GURLEY.

Die geopsychischen Erscheinungen: Wetter, Klima und Landschaft in ihrem Einfluss auf das Seelenleben. By W. HELLPACH. Leipzig, W. Engelmann. 1911. pp. vi., 368. Price Mk. 6.

The author's studies in the psychology of hysteria led him to the idea of a general science of social pathology, which should be grounded upon a social psychology. But social psychology is itself a product of three factors: the anthropopsychical, the factor of psychophysical disposition or of 'race'; the geopsychical, the factor of natural surroundings; and the sociopsychical, the specific contribution of the social life. To understand the third factor, we must be able to eliminate the other two; the study of race and of natural milieu must go hand in hand with the study of society. Partly because geopsychology is the most backward of these three disciplines, and partly because it has an evident practical importance, Dr. Hellpach has prepared the volume before us. He has sifted and appraised observations drawn from a great variety of sources, and the result is a sort of encyclopedia, so arranged that new material can be incorporated with a minimum of disturbance of the text.

The book has three principal topics: weather, climate and landscape, considered as directly influencing the mental life of man. Weather and climate exert a 'tonic' influence; that is, they produce physical and chemical changes in the tension and metabolism of the nervous system and thus affect our 'mood'; landscape, on the other hand, exercises a 'sensory' influence, appeals to us by the way of perception. Weather may be defined as the aggregate state of the atmosphere and of the adjacent parts of the earth's surface at a given place and at a given point of time; climate, as a more or less regularly recurrent sequence of forms of weather; landscape, as the aggregate sense-impression produced by a portion of the earth's surface and the correlated extent of sky.

These topics are taken up in order. Beginning with weather, the author first discusses certain forms of weather which experience has brought into connection with mental 'tone'; thunder storms, hot-dry and hot-wet winds (föhn and sirocco), sultriness, snowstorms, change of weather (clearing up, clouding over, etc.), the time just preceding an earthquake. He then proceeds to an analysis of weather into its elements, atmospheric and telluric. The former are temperature of the air (radiation of heat, cold and warmth of the air), movement, composition, humidity of the air, air-pressure, atmospheric electricity, and irradiation of the air (non-sensory effects of light and dark); the latter are temperature, movement (seasickness!), electromagnetism, composition and humidity of the underlying surface. Three chapters are then devoted to climate. Change of climate covers both variation of climate at a particular place and the 'change' attained by travelling (effects of arctic and subarctic climate; of tropical climate and of 'going south'; of inland and coastal, mountain and valley climates). The 'change of scene' often recommended by physicians works, as a rule, far less by direct climatic influence than by shift of interest, occupation, social relations, etc. (p. 173). An important chapter deals with psychical acclimatisation: habituation to a new climate; the permanent changes, intellectual and emotive, wrought by climate; and the induction of abnormal conditions, of psychoses and of neurotic and psychopathic states: the author writes impartially and with restraint, with full realisation of the sources of error besetting his subject. The final chapter discusses the relation of climate to mental periodicity. As regards the daily rhythm of the mental life,

this relation is exemplified in the alternation of sleep and waking, in the normal curve of depth of sleep, in the daily course of mental work, and in abnormal daily periods; as regards the annual rhythm, in the rutting time, in the periodicity of suicide, sexual misconduct and psychoses, in cyclopathic phenomena and the seasonal change of mood observable in 'nervous' individuals, in the oscillation of mental work, and in the conflict of personal with seasonal periodicity. A concluding section on 'astrophysical' phenomena says what there is to say about *Mondsucht* (somnambulism; cf. our 'lunacy'); refers briefly to the monthly periodicities of the sexual impulse,—not omitting the uncanny behavior of the *un* or *palolo* of the Banks Is.; ascribes the weekly variation of industrial performance to its non-climatic and non-sidereal conditions; and comments upon some alleged daily and yearly cycles,—the eleven-year sunspot period, the thirty-five-year period of climatic variation, Fliess's 23-day and 28-day cycles, and so forth.

From climate the author turns to landscape, and first to the elements of landscape: colors (red and yellow; green, blue, violet, purple; black, white, grey; phenomena of contrast and induction), forms (simple and complex; mass; direction; movement), and non-visual factors (tone and noise; smell; touch). In the case of touch, the distinction between the influence of landscape and that of weather and climate can hardly be drawn with any practical certainty; theoretically, it still obtains. The synthesis of landscape may be effected at very different mental levels. Its primitive mode is a synthesis by symbolisation, as when we think of an autumnal scene as portraying the death of the year, or endow the twilight landscape with our instinctive fear of darkness and solitude. The elementary process of assimilation plays but a small part in the synthetising of landscape; too much detail is given, in direct perception; but the given is often dissimilated (*e. g.* by the clouding over of the sun), whereupon a reassimilation occurs which may introduce a new and permanent synthesis. A characteristic form of assimilation, in our modern attitude to landscape, is 'moralisation' (*Ethisierung*); the scene is solemn, or majestic, or peaceful, not in an aesthetic sense; we are not here concerned with aesthetics; but in the sense of an externalisation of our moral sentiments. Lastly, the 'character' of a landscape, the structure that persists under all the changes of the seasons, may come to us by way of moralisation, in which case the word 'character' assumes something of its narrower and more special meaning, or may be raised by abstraction to the status of an 'ideal.'

Certain landscapes make a peculiar appeal; the author mentions the effect of sunlight, of wide prospect, of hill and valley, night, twilight, late autumn, exotic features. The appeal varies, again, with the age of the individual observer and with the epoch in which he lives. In general, the influence on national life—on usage, taste, belief—that is ordinarily attributed to natural environment, or to climate, or to geographical position, is far more a matter of 'landscape,' in the sense of the present book, than it is of climate in the proper signification of that term.

It remains to outline a programme for geopsychological work. The effect of landscape may be studied by suitably modified forms of the two methods now in use for the investigation of feeling and emotion: the method of expression, and the method of impression (self-observation and self-analysis). It is not permissible, in general, to draw conclusions from the effect of painted scenes to that of the natural landscape. Weather and climate may be approached, first, by the

method of physiopsychical inference: knowing, from scientific experience, that certain bodily conditions often evoke determinate mental phenomena, we may derive or deduce these phenomena from the bodily conditions presented to us; the method is, however, to be applied with great caution. The method of simple self-observation is indispensable. The statistical method is trustworthy only where its results can be submitted to a psychological analysis. Experiments can be made, both on weather and on climate. The best type of weather-experiment consists in the artificial induction of elements of weather, and the noting of their effect upon psychical and psychophysical processes; a comparative method, that should wait upon the changes and chances of the weather, would be less reliable. Climatic experiments, on the other hand, are best made comparatively; tests may be applied in different localities (change of climate) or in the same locality at different times of the year (variation of climate); these procedures may then be supplemented by the artificial induction of climatic 'fragments' (overheating of a room for some hours; excessive humidity maintained for several days). The methods of social psychology are not, for the present at least, available.—

So the book ends. It is a pioneer work, the first attempt at a systematisation of geopsychological facts. Dr. Hellpach has brought together a vast body of scattered observations; he has not found everything, but he has found a great deal; and he has given us a frame into which other observations may be fitted. He writes in a clear and popular style, with well-balanced judgment. The least satisfactory part of his work is, perhaps, the chapter on the synthesis of landscape; he is here dealing with psychological problems of great complexity, and the eighteen pages allotted to the subject are too few. The publication of the second edition in two volumes would permit a more nearly adequate treatment.

Free Will and Human Responsibility. A Philosophical Argument.

By HERMAN HARRELL HORNE, PH. D. The Macmillan Company, 1912. XVI+197 p.

This work is eminently a study in Evolution, the development namely of man's subconscious self. What are we? Where are we? Whither are we bound? So many open questions and yet so much achieved truth. It is an interesting analytic because of its fairness and fullness. Seldom do we find a discussion of so great differences of opinion with so little austerity. Dr. Horne treats his antagonists with such marked courtesy we do not at once discover where the personal element comes in. Liberty men have fought for it in the objective world, "Shouting the battle cry of Freedom." Now comes the battle subjective. Do we verily possess what we have fought for? Is man provably the architect of his destiny?

Professor Horne gives us a series of discussions. He first shows that the same or at any rate analogous issues confront us in other fields. Man's knowledge is everywhere incomplete. In physics, biology, sociology, psychology, theology analogous antitheses appear. Then comes a history of man's achievement down through the ages, his gradual emancipation of himself as possessing freedom of choice, a virtual racial voyage of discovery. This is illustrated best in the religious world where the advancing ethics shows more and more man's consciousness of himself as responsible because originative, causal. Having reached the present problem the author takes up first the evidence that man is simply determined by heredity and environ-

ment. Answering the usual claims that man is absolutely the child of circumstance, he proceeds to give the grounds for recognizing man as possessor of genuine origination, quoting Kant and Fichte and others who have had a world wide influence, maintaining that man is indeed the architect of his destiny for all time.

The chief characteristic, not to say excellence of the work appears in its method. Professor Horne is an authority in pedagogy, and here he practices what he has preached. The *how* to think determines the *what* to think. We are reminded of the Platonic dialogue of which we have before us a modern development. Leaders in his classes were chosen who opened the way to a free battle between the opposing sides. After the class has in this way evoked the differences Dr. Horne gives the summing up, a virtual Hegelian synthesis, the union of opposites. The book is the result of his work in Dartmouth and dedicated to his former students for whom he shows a marked attachment. Freedom we are assured demands a free field, possesses an unlimited arena. As philosophical its discussion has to do with the results of science, and would properly follow Ethics, Psychology, Philosophy of Religion, or History of Philosophy. It is an elucidation rather than an exhaustion of facts. Some will wish that he had developed certain portions of the field more completely. But the outcome of his freedom has complete justification.

The synthesis of results seems to call for a more thorough going psychology of the Will, the bringing out of the relational development of voluntary and non-voluntary, the motive as an accepted preference (non-voluntary) freely allowed to rule over conduct, the purpose as a line of mechanical choices, yet dethronable at any point. Of course the Volition is not creation of energy, only self-direction of attention. Complete intellection would be required to balance complete freedom. But the work is not a Psychology. We take penalties for the race, penalties handed down from our ancestors. The relation of responsibility to knowledge and of penalty to responsibility are very carefully treated. To trace the development of humanity calls for a historical rather than a theoretical exposition. It is a pleasure to find so much facility where we have had so much dogmatism. Possibilities of free choosing involve unlimited variations of treatment. Some would emphasize Kant more. Still we have but to look critically and we encounter the influence of the critical philosophy. Perhaps we are able to peer into the writer's mental history, subconscious development. We certainly feel the import of the philosopher of Koenigsberg as we trace the author's psychical life. The limitations of science are recognized without mention of the critique of pure reason.

Science, history and immediate experience are the basal elements. While there is much that overpasses our comprehension there is a transcending pleasure in the vision of the universe so far as it is known and of man as the king of land and sea, man the veritable possessor of free will and responsibility. Yes, there is increasing pleasure in the conflict, the verification of the unsearchable, not to say divine capacity of the human unit. The open questions only add to the satisfactions of progress. Our Neo-Kantian professor, mindful of the limitations of the pure reason but as well of the postulates of the practical, bows his appreciation to the self-sufficient claims of the empirical pragmatists. Indeed we have in this volume clear verification of the power of our great thinkers upon the subconscious self of the writer. While there are unnumbered problems still to be solved the truths established give free lance to the attainable proofs that man

is verily the architect of his destiny. The thoughtful student will be likely to feel that the fundamental import of the book is virtually epistemology.

G. CAMPBELL.

Dartmouth College.

The Criminal and the Community. By DR. JAMES DEVON. Introduction by Prof. A. F. Murison. John Lane Co., 1912. xiii: 348 pp. \$1.75 net.

This study, while primarily of interest to sociologists, is a contribution in the field of social psychology. The author, Medical Officer in Glasgow prisons, speaks with the authority of 16 years of contact with criminals of all classes. His knowledge of social conditions is equally immediate, seasoned by experience in the ranks of unskilled labour,—by having been in turn, apprentice, artisan, student, physician and man of science.

In treating the problem of the criminal, Dr. Devon applies the point of approach of modern psycho-pathology, that is, presentation of individual cases, extending over long periods. His method is environmental, in the large sense.

His problem is, in brief, first the nature of the criminal himself. The author dissents from Lombroso, finding no causal relation between physical characteristics and crime. Crime is an immediate social product, not an atavism. Here warning is sounded lest the student lose sight of the fact that in prison the individual is subjected to abnormal conditions. To make psychological generalizations is to confuse innate and acquired characters. The problem is individual.

Second, common factors in the causation of crime are taken up. Devon finds only a superficial relation between drink and crime. The great mass of the causal criminal curve falls in between the inequality of economic conditions and abnormal city crowding. Adolescence and crime are not causally related; the correlation appears because society leaves youth unprotected. Nor is crime an attribute of sex. Here the author follows the French, rather than the Italian school.

The third aspect of the problem is the treatment of the criminal, and here Devon makes his most brilliant contribution. He proves by commonplace cases, (1) that present methods have not prevented growth of crime, (2) that they have not been designed to reform, (3) that failure has resulted because treatment is not based on recognition of social conditions as they exist. Prison should be merely the link between detection of maladjustment in the individual to his environment, and application of scientific probation. There is only one principle in penology, that is to study and to treat the individual in relation to his environment (p. 339).

Dr. Devon's study is a departure from stereotyped schools. His successful application of the environmental method is a pioneer achievement in criminology.

MIRIAM VAN WATERS.

The Origin and Development of the Moral Ideas. By EDWARD WEST-ERMARCK. Vol. ii., 1908. New York, The Macmillan Co. pp. xv., 852. Price \$3.50 net.

The first volume of this important work, which appeared in 1906, was reviewed in the JOURNAL, vol. xxi., pp. 334 ff.; the theory of the moral consciousness which the author represents was there set forth, and the plan of the whole undertaking was indicated. That plan involved the detailed study of six typical modes of human conduct. The first mode "includes such acts, forbearances and omissions as directly

concern the interests of other men, their life or bodily integrity, their freedom, honour, property, and so forth"; its discussion fills the second half of vol. i. and the first seven chapters of vol. ii., and ends with a consideration of the origin and development of the altruistic sentiment. The second mode, covering suicide, temperance, asceticism, —acts and restraints which chiefly concern a man's own welfare,—is discussed in the five following chapters of the present volume. The third, referring to the sexual relations of man, occupies four chapters. The fourth, which requires a single chapter only, is the conduct of man to the lower animals. The fifth, conduct towards dead persons, takes two chapters. The sixth and last, conduct towards beings, real or imaginary, that are regarded as supernatural, fills six chapters. A concluding chapter recapitulates the author's theory of morality, and gives his forecast of the future. "We have every reason to believe that the altruistic sentiment will continue to expand and that those moral commandments which are based on it will undergo a corresponding expansion; that the influence of reflection upon moral judgments will steadily increase; that the influence of sentimental antipathies and liking will diminish; and that in its relation to morality religion will be increasingly restricted to emphasizing ordinary moral rules, and less preoccupied with inculcating special duties to the deity." A list of authorities quoted and a full subject-index bring the volume and the whole work to an end.

Dr. Westermarck's position, as we may remind our readers, is that "the moral concepts, which form the predicates of moral judgments, are ultimately based on moral emotions," and that these emotions "belong to a wider class which may be described as retributive; that moral disapproval is a kind of resentment, akin to anger and revenge, and that moral approval is a kind of retributive kindly emotion, akin to gratitude." The moral emotions have an alogical basis: "our retributive emotions are always reactions against pain or pleasure felt by ourselves"; but at the same time "the influence of intellectual considerations upon moral judgments is naturally very great" and, as we have seen, promises to become still greater. This position was worked out in vol. i.; and the present volume adds nothing to it, on the side of ethical theory; the new chapters simply illustrate and confirm, from fresh points of view, the doctrines already enunciated. The reviewer, therefore, has only to add that the treatment here is as erudite and as impartial as it was before. So far as ethnological evidence is concerned, the author has fully made good his claim that no "other theory of the moral consciousness has ever been subjected to an equally comprehensive test."

La psychologie animale de Charles Bonnet. Par E. CLAPARÈDE. Geneva, Georg et Cie. 1909. pp. 96.

The psychology of the Genevan naturalist and philosopher, Charles Bonnet (1720-1793), has been discussed in some detail by Offner (1893) and Speck (1897). The present memoir, published on the occasion of the jubilee of the University of Geneva (1559-1909), deals with Bonnet only as a comparative psychologist. After a sketch of his subject's life and work, Professor Claparède devotes three chapters to his views of the mind of animals, instinct, and the capacity of adaptation to a changed environment. The following chapters discuss Bonnet's ideas regarding maternal love in animals, the comparative intelligence of man and the lower animals, and the 'personality' of creatures, like Hydra and Lumbriculus, whose severed parts may regener-

ate the complete organism. A few pages are given to the philosophical flights of the *Palingénésie*, which the author regards as a sort of defensive reaction on Bonnet's part, due to his need of reconciling the cruelty of nature and the all-goodness of the Creator; and the memoir ends with a lucid summary.

Bonnet—who, it may be noted, employs the terms *experimental psychology*, *psychophysical*, and *psychometer* a century before Fechner appears upon the scene—was essentially an observer, anti-anthropomorphic and anti-teleological, faithfully concerned with facts. His system, so far as he is systematic, is a psychophysical parallelism couched in the traditional terms of dualistic interactionism. He would willingly have dispensed with the notion of mind, and have spoken solely of phenomena of irritability; but mind proved to be indispensable, and accordingly plays its part in his exposition. Nevertheless, Bonnet never seeks to explain by reference to end. "One may say that, in his view, mind reigns, but does not govern. It signs the decrees which the body submits to it in the form of needs, so as to validate them and make them mandatory; but that is all; it never intervenes as a foreign power in the determinations of the body." Bonnet thus has nothing in common with neo-vitalism.

Historically, Bonnet is one of the first students of animal psychology who added experiment to simple observation. His influence upon his contemporaries was large; he inspired much of the work of François and Pierre Huber. His scientific attitude and his positive achievement make his work worthy of study at the present day.

A two-color crayon portrait of Bonnet (perhaps by Michel Liotard), with his signature of 1777, forms the frontispiece of the memoir. Professor Claparède is to be congratulated upon this interesting and useful contribution to the commemorative publications of his university.

The Theory and Practice of Technical Writing. By S. C. EARLE. New York, The Macmillan Company, 1911. pp. vii., 301. Price \$1.25 net.

This little book is intended for engineers; but its usefulness will extend beyond the engineering school. Advanced students in all the sciences are called upon to prepare 'short reports' and 'short and longer treatises,' to express themselves in description, narrative, and the writing of directions, and to submit manuscript to the printer. Professor Earle discusses his subject, both from the theoretical and from the practical side, with admirable clearness and brevity; pt. i., a study of the principles of logical structure, and pt. ii., on the practical application of these principles, occupy respectively just under and just over a hundred pages. An Introduction, of 16 pp., deals with the nature of technical writing, methods of study, and opportunities of training; and a Conclusion, of 10 pp., with methods of writing. A sixty-page appendix furnishes illustrative examples. The work may be heartily recommended. E. B. T.

Life's Basis and Life's Ideal: the Fundamentals of a New Philosophy of Life. By RUDOLPH EUCKEN. Translated by A. G. WIDGERY. London, A. & C. Black; New York, The Macmillan Co., 1911. pp. xxii., 377. Price \$2.50 net.

Present Philosophical Tendencies. A Critical Survey of Naturalism, Idealism, Pragmatism and Realism, with a Synopsis of the Philosophy of William James. By R. B. PERRY. New York and London, Longmans Green & Co., 1912. pp. xv., 383. Price \$2.60 net.

William James and Other Essays on the Philosophy of Life. By J. ROYCE. New York, The Macmillan Co., 1911. pp. xi., 301.

Three Philosophical Poets: Lucretius, Dante and Goethe. By G. SANTAYANA. Cambridge, Harvard University, 1910. pp. viii., 215.

Professor Eucken of Jena, who was awarded a Nobel prize for literature in 1908, is one of the best known of contemporary German philosophers. He is to be classed with men like Kuno Fischer and Paulsen rather than with the systematists in philosophy, and while he writes from ripe experience and full knowledge, his work is most valuable, perhaps, as the expression of a noble and many-sided personality. The present volume—a translation of *Die Grundlinien einer neuen Lebensanschauung*, published in 1907—sets forth the author's theory of Activism, which maintains that "the basis of true life must continually be won anew;" "only through ceaseless activity can life remain at the height to which it has attained." The book, although not technical, is by no means easy reading, and the translation is unnecessarily heavy. For the assistance of non-philosophical readers the translator has prefixed a useful Introductory Note, which gives the main outlines of Professor Eucken's position, and relates it to current modes of philosophising. Such readers may also be recommended to approach Eucken by way of Boyce Gibson's little work, "Rudolph Eucken's Philosophy of Life."

Professor Perry's volume contains a critical discussion, based in part upon articles already published, of the present philosophical tendencies which may be grouped under the headings of Naturalism, Idealism, and Realism. From this he passes to a constructive exposition of his own realistic doctrine: theory of mind, theory of knowledge, philosophy of life. The most interesting chapter, to the psychologist, is that entitled A Realistic Theory of Mind, where he may discover how psychological methods appear when viewed through the prism of a realistic philosophy. An introduction treats of the relation between philosophical theory and established belief, and of scientific and religious motives in philosophy; and an appendix reprints an essay on The Philosophy of William James.

Professor Royce's new book consists of five essays: William James and the Philosophy of Life, Loyalty and Insight, What is Vital in Christianity, The Problem of Truth in the Light of Recent Discussion, and Immortality. Its most important sections are, perhaps, those which discuss the theory of truth (Essay IV., pp. 233 ff.). The remaining essays break no new ground, though they are welcome as throwing light upon various points of Royce's system.

Professor Santayana's studies, based on lectures delivered at Harvard and Columbia Universities and at the University of Wisconsin, are interpretative rather than critical; that of Lucretius is, in the opinion of the present writer, the most successful of the three. Limitations of space, and the definite scope of the JOURNAL, must be the reviewer's apology for this casual and belated reference to a charming book.

Increasing Human Efficiency in Business: a Contribution to the Psychology of Business. By W. D. SCOTT. New York, The Macmillan Co., 1911. pp. v., 339. Price \$1.25 net.

Human Efficiency: a Psychological Study of Modern Problems. By H. W. DRESSER. New York and London, G. P. Putnam's Sons, 1912. pp. xi., 387.

Both of these authors derive their psychology from certain passages in the writings of the late Professor James; both begin their exposition with references to Taylor and Scientific Management; and both exalt Efficiency as a personal and social ideal of living. Professor Scott, however, sticks closely to business; Dr. Dresser takes a wider range. The former discourses of Imitation, Competition, Loyalty, Concentration, Wages, Pleasure, Love of the Game, and Relaxation as means of increasing human Efficiency, of Rate of Improvement in efficiency, of the welding of Theory with Practice, of the Formation of Judgments and Habits,—the various topics being set forth in brief paragraphs (probably to secure relaxation) interspersed with italicised summaries (to secure concentration). The book is less a contribution to the psychology of business than a reading of certain business principles and results in the light of a highly schematic psychology.

Dr. Dresser teaches that "efficiency in the largest sense is a synonym for the art of life, for adaptation to nature." Psychologically, his acceptance of this ideal leads him "to restore the will to its proper place in contrast with recent interest in suggestion and the sub-conscious;" ethically, it leads to the doctrine of self-realisation. The keynote of the book is the writer's insistence on the possibility of conscious control. "Bundles of tendencies we surely are;" but "for every man who wills to become highly efficient there is a way to acquire inner control, to master habits, wasteful emotions, troublesome moods, and all other adverse mental states;" "the rational way to think is with reference to the consistent, ideal self we will to become, the self which life is ready to develop in us." Dr. Dresser tends to a homiletic style, and does not always escape the danger of platitude ("He who loves his work will find a way to do it well;" "Time settles many matters which persistent thought could not solve"). He has extended the meaning of efficiency to include moral and spiritual values; yet the suggestion of industrial efficiency is always present; and the reader, puzzled by the many shifts and enlargements of reference, will probably hold fast to that as the type of efficiency in general. The reviewer is persuaded that Efficiency is not the goal of human living. But, be that as it may, the author would do well to bear in mind the procedure of that Socrates whom he praises as the "pioneer of precise thinking," and to pay more regard to definition and induction.

A Text-book in the Principles of Education. By E. N. HENDERSON. New York, The Macmillan Co., 1910. pp. xiv., 593. Price \$1.75 net.

Outline of a Course in the Philosophy of Education. By J. A. MACVANNEL. New York, The Macmillan Co., 1912. pp. ix., 207. Price 90 cents net.

Professor Henderson discusses the principles of education under the three headings Education as a Factor in Organic and Social Evolution, The Process of Education in the Individual, and The Educational Agencies. The treatment throughout is frankly teleological, and mind, conscience and all the higher powers of the individual are treated from the utilitarian point of view. At the same time, the author makes it clear that successful practice is not the be-all and the end-all of human living; there is room for idealistic philosophy; and "education in a democracy means a vocational training for each and

liberal culture for all." The Idealism of Service cannot, by some of us, be accounted the last word of philosophy; and the inability of final causes to explain might have been set forth in greater detail. Within his self-imposed limits, however, Professor Henderson writes with commendable clearness and thoroughness.

Professor MacVannel's *Outline*, a revised and somewhat unevenly expanded syllabus prepared originally for the use of his students in the classroom, is intended to aid the reader in following a course of lectures on the subject and, more generally, in systematising the knowledge that he may have acquired. The author's philosophy appears to be humanistic, his science evolutionary and finalistic, his psychology dynamic, and his education social. The forty section-headings of the syllabus will, no doubt, help the beginning student to pigeon-hole facts and theories.

La crise de la psychologie expérimentale: le présent et l'avenir. Par N. KOSTYLEFF. Paris, F. Alcan, 1911. pp. 176.

The book opens with destructive criticism. Experimental psychology has worked at random; it is wholly unable to reduce its results to a system of knowledge; it has, indeed, no results of importance to show. Psychophysics, physiological psychology, psychometry have all alike followed blind paths that lead them nowhere. The synthesis offered by Toulouse, Piéron and Vaschide is clear but jejune; that offered by Titchener is full but imperfect. Binet was on the right road in his study of intelligence, but he ends, after all, with a series of practical tests which take him far away from psychology. The Würzburg school has shown an increasing tendency to metaphysical speculation.

What shall be the remedy? The great mistake of experimental psychology has been to take its subject-matter statically and not dynamically. All mental processes—we catch hints of this position in the work of Mach, Wahle, Bourdon, Nuel—must be regarded as complexes of cerebral reflexes; all the rich variety of the mental life must be explained by the composition of these reflexes. Pawlow, and more especially Bechterew, have pointed the way to an objective psychology; Berger and Anderson, Girard and Frédéricq, have thrown light on the physiology and physical chemistry of the brain-reflex. We must combine Bechterew's procedure with that of introspection, and must work genetically; children must be brought together in psychopaedological institutes for systematic examination. The study of words will tell us when the first true 'image' appears; we may then go on to ask which appears first, object-image or quality-image, substantive or adjective, heterosensory or homosensory reflex-groups; and so we may pass to the earliest judgments, to memory and association, to abstraction, to wordless or imageless thinking, to reasoning, to attention. We shall thus obtain a psychology that is both objective in its grounding and outlook and systematic in its scope and presentation.

So the author. Criticism is wholesome; and his criticism of experimental psychology contains, no doubt, a measure of the truth. It loses a good deal of effectiveness, however, when we realize that M. Kostyleff has a hobby of his own; that he would confine the science to what is now one of its many directions, and tie it down to a certain plan and a certain method that now have many rivals. Clearness of thought is a great virtue, and psychology can only profit if this theory and point of view are carried to their logical conclusion and thoroughly tested by experiment. Meanwhile, the book will not alarm those who are trying to clarify and to systematise on other principles.

E. B. T.

BOOK NOTES

The Theories of Evolution. By YVES DELAGE, M. D. and MARIE GOLDSMITH. Tr. by André Tridon. New York, Huebsch, 1912. 352 p.

This is an excellent and concise statement of the present condition of the problems of evolution. First come the fore period and that represented by Darwin, although most of the chapters are post-Darwinian. The topics since Darwin that are treated here are natural and sexual selection, theories of heredity, Spencer's units, Nägeli, DeVries, Weismann, germinal selection, Roux, Galton, Mendel, transmission of acquired characters, theories, observations and experiments, Lamarckians, organic selection, isolation, orthogenesis, mutation. Everything is clear and concise, though perhaps a little simple and elementary. It is somewhat to be regretted that the book contains so very few references to literature on the subject.

The scope of formal logic. By A. T. SHEARMAN. London, University of London Press, 1911. 165 p.

This comprises five chapters as follows: explanation of terms, variation of symbolic procedure, examinations of properties in generalized logic, general logic and the common logical doctrines, general logic as the basis of arithmetical and geometrical processes, philosophical treatment of number and of space.

Die Abstammungslehre: eine gemeinverständliche Darstellung und kritische Übersicht der verschiedenen Theorien mit besonderer Berücksichtigung der Mutationstheorie. Von P. G. BUEKERS, Leipzig, Quelle & Meyer, 1909. 354 p.

This is a general survey of the subject of descent and is designed to be both popular and critical, setting forth special theories but with most reference to mutation. The main chapters are historical, propagation, systematics, variability, purposiveness and adaptation, natural and artificial selection, unpurposiveness, auxiliary theories (under which are included sexual selection, correlation, variations, Nägeli's perfection theory, animistic notions like Haeckel's and germinal selection), criticism of adaptation theory, sexual increase and death before maturity, limited action of selection, mutation and selection, a glance into the development-history of living nature.

Über den Willensakt und das Temperament. Von NARZISS ACH. Leipzig, Quelle & Meyer, 1910. 324 p.

This is a very careful series of experimentations, by the man who now happily occupies the chair of Kant in Königsberg, upon the will. He caused a series of impressions to become habitual if not merely memorized and then his subjects by an act of will had to break in upon the series in various ways and introspect. We have then here a closer ranged view of the processes of will than hitherto, which sheds very much new light. Though the work as a whole is perhaps not so interesting as the author's original study of will, it is nevertheless

of great interest and significance. It would not be surprising if the most valuable part of it all proved to be what he has to say at the end concerning feelings as involved in the acts upon which his experiments were directed.

Empfindung und Denken. Von AUGUST MESSER. Leipzig, Quelle & Meyer, 1908. 199 p.

This is a very interesting study. It begins by discussing the sensory elements in outer perception and then tries to delineate the thought elements in it, then passes to inner perception, attention and abstraction, sentence and judgment, lapse of thought and knowledge, psychological and logical discussions of thought and finally, the pedagogical implications of all this.

Die Grenzwissenschaften der Psychologie. Von W. HELLPACH. Leipzig. Dürr, 1902. 515 p.

The author first treats the anomaly of the nervous system, then animal physiology, neuropathology, psycho-physiology and developmental psychology. It was well indeed, now that psychology is narrowing down and particularly laboratory psychology is drawing in its phylacteries, to have psychologists at least instructed upon the boundaries of their kingdom on all sides. This is what this writer attempts to do and very properly dedicates his work to Wundt.

Handbook of mental examination methods. By SHEPHERD IVORY FRANZ. New York, The Journal of Nervous and Mental Diseases Publishing Co., 1912. 165 p. (Nervous and Mental Disease Monograph Series, No. 10.)

This work discusses sensation, movement, speech and aphasia, attention, apprehension and perception, memory, association, time of mental processes, general intelligence and examination, methods of dealing with observational data.

Das Problem der objectiven Möglichkeit: eine Bedeutungsanalyse. Von AUGUST GALLINGER. Leipzig, J. A. Barth, 1912. 126 p. (Schriften der Gesellschaft für psychologische Forschung. Heft 16, IV Sammlung.)

The author discusses here connections of being positive and negative, the idea of ground, especially of knowledge. After discussing the idea of objective possibility, he distinguishes and discusses separately its empirical, regulative, concrete, abstract and hypothetical possibility, contrasting possibility and impossibility.

The economy and training of memory. By HENRY J. WATT. Second Impression. London, Edwin Arnold, 1909. 128 p.

The best chapter in this little book is the author's account of the experimental investigation of memory, the factors which influence it and mental imagery. The book shows a pretty good knowledge of the many experiments in memory during the last twenty-five years.

Logik der reinen Erkenntnis. Von HERMANN COHEN. Berlin, Bruno Cassirer, 1902. 520 p.

After an introduction, the chief topics here are the judgments of the thought processes, especially the judging of original identity and

contradiction. Then come the judgments of mathematics, such as reality, plurality, universality, then of the mathematical sciences, substance, law, idea and finally, judgments of method, *e. g.* possibility, reality, interest and limitation.

Beauty, ugliness and other studies in psychological aesthetics. By VERNON LEE and C. ANSTRUTHER-THOMSON. New York, John Lane Company, 1912. 376 p.

The writer begins with anthropomorphic aesthetics, then discusses its empathy, its organic accompaniments, then passes to its central problem as represented by Münsterberg, Titchener and the Würzburgers. Beauty and ugliness are next considered and then aesthetic responsiveness in its variations and accompaniments based on the author's own experiences.

Psychophysik. Von W. WIRTH. Leipzig, S. Hirzel, 1912. 522 p.

This memoir which very fittingly comes from Leipzig is the most comprehensive and as it ought to be, by far the most valuable treatment of its subject for many years. The author treats of the methodic questions including self-observation and experiment, quantitative and qualitative analysis, then takes up auxiliary aids from the domain of collective Masslehre, then the methods of reproduction which is really the best part of the book and finally, treats of the reaction method.

Chapters from modern psychology. By JAMES ROWLAND ANGELL. New York, Longmans Green & Co., 1912. 308 p.

This volume contains lectures at Union College early in 1911. The matter is arranged for a general college audience and the author treats in his eight lectures of general, physiological, experimental, abnormal, individual and applied, social and racial, animal and finally general genetic psychology, with a retrospect.

Aristoteles über die Seele. Neu übersetzt von ADOLPH BUSSE. Leipzig, Felix Meiner, 1911. 120 p. (Philosophische Bibliothek, Band 4.)

Ascétiques et mystiques. Par ABBÉ JEAN DELACROIX. Paris, Bloud & Cie, 1912. 61 p. (Questions théologiques.)

Fatigue. By F. L. WELLS. Reprinted from the Psychological Bulletin, November, 1911. Vol. 8, No. 11, pp. 390-395.

Ueber den Traum: experimental-psychologische Untersuchungen. Von J. MOURLY VOLD. hrsg von O. Klemm. Zweiter Band. Leipzig, J. A. Barth, 1912. pp. 449-879.

The second volume begins with the fourth section and is devoted to non-experimental and normal dreams where the author continued his method of investigating the upper extremities, especially stimulating the right and left hands. He also makes some interesting conclusions in the last section concerning the relation of dreams to various conditions and what the elements are which enter into their composition, discussing incidentally dreams of floating and hovering, dreams of dreams and speech in dreams.

Die Seele des Kindes. Von W. AMENT. Stuttgart, Franck, 1911. 93 p. (Dritte, verbesserte Auflage.)

This is a rather copiously illustrated story of child life which embodies various previous works of the author and covers the entire period from birth to well rounded adolescence.

Über die psychologischen Theorien Freuds und verwandte Anschauungen, Systematik und kritische Erörterung. Von ARTHUR KRONFELD, Leipzig, Wilhelm Engelmann, 1912. 120 p. (Sammlung von Abhdlgn zur psy. Pädagogik aus dem Archiv für die gesamte Psychologie, hrsg. von E. Meumann. III. Band—I. Heft.)

This is by far the most searching study that has ever been made of the Freudian precepts. The first part is taken up with an exposition which is a model of condensation and lucidity. The second part is devoted to criticisms. The latter are directed mainly against some of Freud's mechanisms but the chief fault found is with the clearness and consistency of his basal philosophical principles. Most of these points seem to the writer of this review well taken, but it should not be forgotten that Freud is not a philosopher; but that he has made all his most epoch-making new departures on the basis of a very prolonged and wide-ranged clinical experience and that he has had the insight and sagacity to penetrate into the meaning of these cases in a way that has shed new light upon the structure and functions of the human soul.

Criminal responsibility and social constraint. By RAY MADDING MCCONNELL. New York, Charles Scribner's Sons, 1912. 339 p.

The first part is devoted to the aims of punishment, viz., expiation, retribution, deterrents, reform and social utility; part second to freedom in crime, psychology of will, motive and choice, mental causation, freedom which is identified with ignorance of causes, determinism assumed in daily life and in science, the testimony of self-consciousness, freedom or absence of external constraint, character and environment, transcendental freedom. The third part is devoted to responsibility for crime and treats of early extremes and present practices, arguments for complete irresponsibility, contrast of moral considerations and social expediency, the basis of personal accountability and of social constraints and practical procedures.

Nervous and mental diseases. By ARCHIBALD CHURCH, M. D., and FREDERICK PETERSON, M. D. Philadelphia, W. B. Saunders Co., 1911. 932 p. (Seventh thoroughly revised edition.)

It is very creditable to the medical profession that this valuable work has reached already a seventh edition and to the authors that it has been thoroughly revised by over 150 interpolations of varying lengths. Five important chapters have been largely rewritten and the various recent theories of the nature of hysteria have been outlined.

The biology of physa. By JEAN DAWSON. Behavior Monographs, vol. 1, No. 4, 1911. Serial No. 4, 120 p.

This is a very interesting and valuable paper and the result of a great deal of very painstaking work. The author first discusses the relation of the freshwater snail to its natural environment, then the

mucus and the mucous threads of physa, then its food and food activities, then its respiration and finally, describes some psychic phenomena.

The evolution of vertebrates and their kin. By WILLIAM PATTEN. Ill. Philadelphia, P. Blakiston's Sons & Co., 1912. 486 p.

This author has spent many years in teaching and studying biology and all this time has been possessed with the idea of uniting the branches of the animal kingdom into a natural coherent system or genealogical tree that would indicate the rise and decline of the important functions and organs and map out the highway of organic evolution and even assign in biological terms the approximate days and surroundings for the critical events, etc. The main point here is to discover which one, if any, of the many existing invertebrate phyla form the trunkline of descent from the lowest vertebrates to the coelenterates and through them to the protozoa. The author holds the McNard theory of the origin of vertebrates and gives this considerable space in the first chapters of his book which—although it is hardly in the line of this journal to discuss in detail—appears to be one of very great interest and significance which every genetic psychologist will greatly profit by knowing.

Prehistoric man. By W. L. H. DUCKWORTH. New York, G. P. Putnam's Sons, 1912. 156 p. (The Cambridge Manuals of Science and Literature.)

The ground covered by this little book is the precursors of paleolithic man, alluvial deposits in the cave, associated animals and implements, human fossils and the geological chronology, human evolution in the light of recent research. This seems to be a very sensible and condensed little finder and it has an excellent collection of literature.

A new logic. By CHARLES ARTHUR MERCIER. London, Heinemann, 1912. 422 p.

The author premises that his professional brethren will look askance upon a physician who wastes his time on logic and that logicians will regard him "with the contemptuous abhorrence that is bestowed all the world over by professionals upon the amateur." He certainly does go his own way regardless of the logic of schools, treating first the proposition, its nature, meaning, kinds, constitutions, ratio, terms, their origin and kinds, a new doctrine of quantity with particular distributive rules, the individual, the single, intensive, comprehensive quality, including classification, negative terms and modes of denial. The second book is devoted to empirical reasoning, the indirect appeal to experience, imperfect induction. The third book is on the methods of explication involving the laws of thought, the canons of inference, the implications of simple and compound propositions, faults of the rules of a syllogism, conditional proposition and its implication. The fourth book is on analogy, composite reasoning, fallacies and the faults of the existing systems, while the appendix contains a suggestive note upon the classification of sciences.

Syphilomanie et syphilophobie. Par ALEXANDRE MOVHAN. Paris, Henri Jouve, 1909. 70 p.

Syphilis has a moral affect upon sound people and many more who are affected by it. Each deserves to be a special mental syndrome or

rather two of them. The first this writer calls syphilomaniacs who have a certain indemnity for the disease when it comes and often take refuge in hospitals and retreats. Their mental state is more or less carefully attended and may or may not be cured. On the other hand, syphilophobiacs are syphilitics and their phobia may be transient or permanent. The individual reaction is measured by the intensity of the emotivity. One variety of these phobiacs are altruists, but these are not discussed here. This phobia can impel to suicide or crime. Both manias and phobias are sometimes an extension in the nervous field of neuropathic heredities of various kinds, although sex and profession have less influence. The reputation of vareole on which quacks pronounce is the chief generator of this phobia. Treatment should be general and social prophylaxis with instruction for the masses, distinguishing between what is to be feared and what is not. Individual treatment ought to be attempted, but the nervous therapeutics is rather limited. Travels, substitution of a mania, pardon, consolation, encouragement are indicated.

La formation directe du raisonnement chez l'enfant. Par M. GUÉCHOT. Paris, Hachette et Cie, 1909. 45 p.

This little book discusses the following subjects: how the infant comes to know its senses, attention, reflection, direct observation and the rôle of consciousness, the sources of sensation, objects and the actions essential in an object, the essence of action, how and why, the elements of teaching French and intellectual formation, the rôle of grammar, the importance of reading in relation to the development of attention and the formation of reason, direct observation and internal observation, moral education.

Edgar Poe. Par ÉMILE LAUVRIÈRE. Paris, Bloud et Cie, 1912. 252 p. (Les Grands Écrivains Étrangers.)

This monographical study gives the life of Poe and connects it at each point with his works. The author has evidently made a very careful study and discusses his theory and gives an interesting account of the genesis of the terror he expresses in the Raven, with interesting side remarks on fear. His heredity he finds to be very wretched, his youth irregular, his works only partly sane and his death premature and miserable.

Die nervösen Angstgefühle. Von THOMAS MAINHARDT. Leipzig, Wendel, 1908. 128 p.

The writer first discusses the nature and origin of the various conditions of anxiety, the modes of avoiding fear, anxiety about witches, anxieties connected with the heart, diseases, with callings, heredity, sex anxiety caused by things heard and shown, agoraphobia, certain neurasthenic feelings of anxiety, the natural methods of healing, gymnastics and Turnen, and the hypnotic processes.

Les localisations cérébrales: esquisse méicale et psychologique. By JEAN FERRAND. Paris, Rousset, 1911. 87 p.

This is a rather severe arraignment of present theories and methods of determining cerebral localization because it has a materialistic moral. The precipitant tendency to utilize anatomical, clinical and physiological facts for the determination of problems that are essentially metaphysical is wrong. Condemnation of the theory of images and the doctrine of the associationist seems a real triumph of the old spiritualistic philosophy which will survive all attacks.

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THE SCHEMA OF INTROSPECTION

By E. B. TITCHENER

1. *Introspection as a Generic Term*

I have shown in a previous paper¹ that the term Introspection, as we find it used to-day, is highly equivocal, and that the procedure which it connotes may be scientifically illegitimate, or even wholly imaginary. I reserve the name henceforth for methods that are scientifically available and that appear to have been actually employed. The plural form 'methods' is still in order; for introspection, even with this limitation, remains a generic term and, in so far, a term of equivocal meaning. Let us suppose that the 'subjective' conditions of observation—observational type, general training and special practice, temporary disposition and the like—have all been standardised: nevertheless, the course that an observer follows will vary in detail with the nature of the consciousness observed, with the purpose of the experiment, with the instruction given by the experimenter. Introspection is thus a generic term, and covers an indefinitely large group of specific methodical procedures.

The common trait that holds these methods together may be characterised in various ways. We may say, for example, that all introspection presupposes the standpoint of descriptive psychology. The results to which it leads belong to what Jevons calls 'empirical knowledge,'² and are logically

¹ Prolegomena to a Study of Introspection, this JOURNAL, xxiii, 1912, 427 ff.

² W. S. Jevons, *The Principles of Science*, 1900, 526 ff.

prior to any sort of systematisation of conscious phenomena. There are, to be sure, different levels of psychological observation: we may accept a terminology, or a generalisation, or the preliminary chapters of a system, and may proceed to observe in these terms and on this basis; and there are, again, different backgrounds of observation: we may postulate a certain type of system, and so commit ourselves beforehand to a particular mode of explanation. But the data of introspection are never themselves explanatory; they tell us nothing of mental causation, or of physiological dependence, or of genetic derivation. The ideal introspective report is an accurate description, made in the interests of psychology, of some conscious process. Causation, dependence, development are then matters of inference.³

We may say, again, that the introspective methods do us the same service in psychology that the inspective methods—'observation and experiment' is the more usual phrase—do in natural science. To get a rough appreciation of the scope and the limitations of introspection, we have then only to shift the scene to chemistry or biology, and to realise what can be accomplished in those sciences by methods of direct and indi-

³ I quote a few passages. In general, "introspection of itself cannot furnish a theory of our psychical processes:" O. Külpe, *Grundriss der Psychologie*, 1893, 10. As regards causation, "association, the connection of ideas, is not a phenomenon of consciousness. . . . We thus formulate an hypothesis; we do not note a fact of consciousness that is evident of itself:" E. Claparède, *L'association des idées*, 1903, 6 f. As regards dependence, "the sensation as such . . . neither refers us to the organs in which it has arisen under the operation of external or internal stimuli, nor indicates the character of these stimuli themselves:" W. Wundt, *Phys. Psychol.*, i, 1893, 412; cf. *Philos. Studien*, ii, 1885, 302 ff. As regards development, "psychology, in order to make valid its claim to be a science, must not merely display" the facts ascertained by introspection; it must also, among other things, "trace the stages of their development from what is simpler to what is more complex:" G. T. Ladd, *Elements of Physiol. Psych.*, 1887, 10; cf. J. M. Baldwin, *Mental Development in the Child and the Race: Methods and Processes*, 1895, 3 (where the 'genetic conception' is placed under the heading 'explanation' as opposed to 'description'). Indeed, the statement of the text would be simply a commonplace were it not that this natural limitation of the observational method is sometimes made a reproach to introspection. Cf., e. g., R. Dodge, *The Theory and Limitations of Introspection*, this JOURNAL, xxiii, 226: "Introspection has never been able to fill out the causal relations of any fact of consciousness," etc. But neither does external observation reveal physical causation; that is always an inference,—based on observation, and confirmed by observation, but none the less an inference. Or cf. N. Kostyleff, *Les travaux de l'école de Wurzburg: contribution à l'étude objective de la pensée*, *Rev. philos.*, lxx, 1910, 554, 570, 576, 580.

rect observation. There is, perhaps, no reason to fear that this statement will be misinterpreted; but to avoid possible misunderstanding I add two qualifying remarks. In the first place, if we are to interpret it aright, we must free ourselves of the popular belief that the experiment of natural science is an explanatory test; we must recognise that, while an experiment may have an explanatory value, it is itself observational. And in the second place we must remember that the resemblance between inspection and introspection is a broad and general likeness, which consists with all manner of difference in degree and in detail. It has, of course, been customary for psychological text-books to emphasise these differences; and I do not suppose that the weight of tradition and authority can be overcome all in a moment. I am convinced, however, that the right way to approach the study of psychological method is to assume that it is, in all essentials, identical with the observational procedure of the natural sciences.⁴

The thesis that introspection is simply the common scientific method of observation, applied from the standpoint of a descriptive psychology, was maintained explicitly by Pillsbury in 1904: "It would seem that introspection differs from [external] observation only in the attitude of mind as we examine the mental process."⁵ I argued to the same

⁴With the above paragraphs cf. G. E. Müller, *Zur Analyse der Gedächtnistätigkeit und des Vorstellungsverlaufes*, i, 1911, 63 sub fn., 81 ff. Readers of my earlier paper will not need to be reminded that I mean here, by 'psychological experiment,' such an experiment as only a man with specifically psychological training is capable of performing. Many other sorts of experiments are made, by psychologists, in the interest of the psychological system; and these may properly be termed, in another context, 'psychological experiments,' but they are not now under discussion.

⁵W. B. Pillsbury, A Suggestion toward a Reinterpretation of Introspection, *Jour. Phil. Psych. Sci. Meth.* i, 1904, 228. The title of this paper shows that the author regards his position as novel. He thinks, however, that it is implied in the work of Wundt and Külpe; and, indeed, if we accept formal statement in the one case and actual procedure in the other, we may find evidence to that effect: see, e. g., W. Wundt, *Logik*, ii, 2, 1895, 170 ff.; O. Külpe, *Grundriss der Psych.*, 1893, 8 ff. The same thing may be said of H. Münsterberg, *Ueber Aufgaben und Methoden der Psych.*, 1891, 145, 153 ff. It is notoriously difficult, in cases like this, to refer an idea specifically to men and dates. James, e. g., declares that psychology is a natural science, and yet offers an account of introspection that differentiates it from external observation (W. James, *Princ. of Psych.*, i, 1890, 183 ff.). Robertson writes that "psychology, by itself, is in the first instance positive phenomenal science—positive as to its method, phenomenal as to its subject-matter. Its method does not differ from that of other positive sciences, like biology or chemistry, except as the method of any science is modified by the peculiarity of its subject." There is, however, an

effect in 1908;* and Müller has taken a like position in his recent work on Memory.[†]

But if this thesis is correct, have we any reason for keeping the term introspection in our psychological vocabulary? None at all, I think, if we consider the matter from the point of view of an abstract methodology. On the other hand, this introspection, or observation from the standpoint of psychology, is the unique business of the psychologist; it is something that the psychologist's training fits him to do, and that no other form of scientific training leads up to or includes. Everything else that belongs to the system of psychology can, formally or theoretically, be done just as well by the physicist or biologist as by the psychologist,—though it is true that adequate and satisfactory explanations in psychology may be expected rather from the man with special psychological training and knowledge than from the student of general science or from the specialist in some other field. Introspection, then, is in a peculiar and exclusive sense the business of the psychologist, and it is well that this business should have a specific name. When, moreover, we have a traditional term, that is full of misleading suggestions to the student, it is wiser to adopt that term, reading the suggestions out and reading a sound definition in, than to pass it by and introduce a new coinage.

The Stimulus Error.—It would be foolish to blink the fact that our current text-books still point out a number of alleged differences between introspection and inspection. In the main, however, these statements do not rest upon empirical induction, but rather derive from the authors' epistemology. The truly empirical differences will be variously rated by different psychologists; the time is not yet ripe for a point-by-point comparison of the methods. Meanwhile, those psychologists who do not regard the differences as fundamental must walk warily, or they will find that, so far as the teaching of psychology is concerned, they have bought their insight at a high price. The idea of an unique method, a specific way of working, is far more easily grasped by the beginner in psychology than is the idea of a shift of mental attitude. Indeed, the reformed doctrine opens a wide door to the 'stimulus error.' The observer in a psychological experiment falls into this error, as we all know, when he exchanges the attitude of descriptive psychology for that of common sense or of natural science; in the typical case, when he attends not to 'sensation' but to 'stimulus.' Now, in work upon color-equations, *e. g.*, it makes little difference whether the observer regard himself as matching color-sensations or colored papers. But one cannot make any large number of observations, even in the simplest fields of sense, without discovering that the confusion of attitudes has very serious consequences. The stimulus error is, in fact, the material aspect of what appears, in more formal guise, as the error of logical reflection or of *Kundgabe*; it is an error both subtle and pervasive; and the more closely our psychological

'in the second instance' which marks off psychology, method and problem alike, from the natural sciences (G. C. Robertson, *Psychology and Philosophy*, *Mind*, O. S. viii, 1883, 9; *Elements of Psychology*, 1896, Editor's introduction, xi). J. S. Mill declares that there is a science of mind, whose methods are observation and experiment (*A System of Logic*, bk. vi, ch. 4, § 2 [1884, 556]); but I need not say that we should go far astray if we took this statement *au pied de la lettre*.

* *Feeling and Attention*, 1908, 175 ff., 354 ff. Cf. *Text-book*, 1909, 19 ff.; R. M. Yerkes, *Introduction to Psychology*, 1911, 39 ff.

† *Op. cit.*, 64 ff., 81 ff.

method approximates the methods of observation employed in other laboratories or in daily life, the greater is the likelihood that our students fall victims to it.

The stimulus error may even affect our views of introspection itself. At a recent meeting of Experimental Psychologists it was urged, with special reference to tachistoscopic experiments, that introspection is wholly unreliable; for if we compare the observer's reports with the stimuli actually exposed, we find that he may see what was not there at all, may fail to see much of what was there, and may misrepresent the little that he really perceived; introspection adds, subtracts, and distorts. The question, however, so far as the validity of introspection is concerned, is not whether the reports tally with the stimuli, but whether they give accurate descriptions of the observer's experimental consciousness; they might be fantastically wrong in the first regard, and yet absolutely accurate in regard to conscious contents. In other words, the objection issues from the stimulus error. The observer is trying to describe a consciousness; not certain objective letters or figures, but the consciousness which a brief exposure of these stimuli induces. His description may be mistaken or inadequate, and we must use every possible methodological means to discover its mistakes and to supplement its omissions; but we cannot gauge the method by reference to the stimuli.

It seems, therefore, that if we assimilate introspection to inspection we must, in laboratory practice, be more than ever on our guard against the stimulus error. We shall invert Steinthal's story;⁸ and, letting geologist, farmer, landscape gardener, psychologist, traverse and report upon the same bit of country, we shall explain that all four reports may be equally true, but that each one plainly implies a particular attitude, a special point of view. It is the attitude and point of view, not the method, which must henceforth serve to distinguish the introspecting from the inspecting man of science.

Phenomenology and Descriptive Psychology.—I have tried in other writings to show the nature of this 'descriptive psychology' whose methods are summed up by the term 'introspection.' On the positive side, I have here nothing new to add. On the negative side, I would warn the reader against confusing descriptive psychology with a 'phenomenological' account of mind. The word 'phenomenology' has played a large part in recent discussion, and has been variously defined. In the present connection I mean, by a phenomenological account of mind, an account which purports to take mental phenomena at their face value, which records them as they are 'given' in everyday experience; the account furnished by a naive, common-sense, non-scientific observer, who has not yet adopted the special attitude of the psychologist, but who from his neutral standpoint aims to be as full and as accurate as the psychologist himself. It is more than doubtful whether, in strictness, such an account can be obtained. We can hardly, with the pressure of tradition and of linguistic forms upon us, consider mental phenomena in a really naive way, with a truly blank prescientific impartiality; our common sense runs to logic, embodies a psychology of reflection; face values are, in fact, highly sophisticated values, and things given are things that have been many times made over. The proof, if proof be needed, is that phenomenology, when it leaves what might be thought its proper sphere of gross description and

⁸ H. Steinthal, *Einleitung in die Psychologie und Sprachwissenschaft*, 1881, 167 f.; translated by W. James, *Principles of Psychology*, ii, 1890, 108.

takes to analysis, tends inevitably to analyse under logical categories; it works out implications, while descriptive psychology—under the same *Aufgabe* of analysis—teases out the existential factors in the consciousness to be described. A phenomenological 'system' is therefore an epistemological *tour de force*, rather than a prepsychological synthesis of the data of psychology.

We need not hesitate to admit, on the other hand, that a roughly phenomenological account, a description of consciousness as it shows itself to common sense, may be useful or even necessary as the starting-point of a truly psychological description. The psychologist may attempt it; or it may be supplied by the novelist, or the diarist, or by any untrained but alert observer. The psychologist may also have recourse to phenomenology after the event, after he has completed his own first analysis, as an additional check upon the singly motivated and more technical description. Or again, the elaborate phenomenology that issues from a foregone epistemology may be of service as indicating possible *lacunae* in psychological description. But phenomenology, as I am here using the term, is not psychology; and if, as will naturally be the case, phenomenological and psychological results are sometimes in accord, this casual agreement must not tempt us to generalisation or lead us to identify different attitudes toward experience.*

2. *The Introspective Schema: Free and Controlled Consciousness*

In an attempt to reduce observation to its lowest scientific terms, I have said that it "implies two things: attention to

*The phenomenology that I have in mind is, of course, that of Husserl, and not that of Brentano and Stumpf. An adequate discussion would require another article; I can here only express my opinion that no form of phenomenology—phenomenology of mind, *Gegenstandstheorie*, science of selves—can be truly scientific, for the reason that the implied attitude to experience is multiply motivated and fluctuating, while the *minimum* requirement of science is a fixed and constant point of view.

With the general subject of the above paragraphs, cf. A. Messer, Husserls *Phänomenologie in ihrem Verhältnis zur Psychologie*, *Arch. f. d. ges. Psych.*, xxii, 1911, 117 ff.; W. Wundt, *Psychologismus und Logizismus*, *Kleine Schriften*, i, 1910, 511 ff.; and, more especially, G. Reichwein, *Die neueren Untersuchungen über Psychologie des Denkens nach Aufgabestellung, Methode und Resultaten übersichtlich dargestellt und kritisch beurteilt*, 1910, 116, 125 f., 136. This work, a doctorate thesis of the University of Halle, written under Meumann's direction, seems to have failed of its due recognition, both in Germany and in America. It undertakes a detailed comparison of Wundt's psychology of thought with the doctrines of the Würzburg school; and the author maintains, I think correctly, that Wundt's position, whether right or wrong upon special points, is more consistently psychological and implies a wider psychological perspective than that of his opponents. The comparison is all the more timely since the Würzburg authors have, in general, made little more than incidental reference to Wundt, and since Wundt's views have been grossly misrepresented by certain critics (J. B. Sauze, *L'école de Wurtzbourg et la méthode d'introspection expérimentale*, *Rev. de philos.*, xviii, 1911, 225 ff.; F. A. Gemelli, *L'introspezione sperimentale nello studio del pensiero e della volontà*, *Riv. di psicol. appl.*, vii, 1911, 289 ff.).

the phenomena, and record of the phenomena.”¹⁰ Psychological observation implies, accordingly, an attention from the standpoint of psychology, and a record in the terms and under the captions of psychology. And if we are seeking a first, provisional classification of the introspective methods, we shall look for salient differences in the conditions under which attention is given and record is made.

This course is, in fact, followed by Müller in his recent work on Memory. The essential thing in every case of introspection, Müller says, is that some conscious process or part-process, some state of consciousness or complex of states of consciousness, is made the object of a ‘conscious psychological apperception.’ This apperception is an appraisal, a judgment, a ‘placing,’ from the psychological standpoint, of the state or process which is to be observed. It may be explicit, consisting of a “properly formulated sentence in internal speech, to which may even be added an inner comment such as ‘important!’ or ‘don’t forget!’” Or again it may be sketchy and fleeting, and make but little claim upon consciousness,—consisting perhaps of the bare suggestion (*das mässig deutliche Anklingen*) of verbal glosses, visual ideas, and so forth. The method is completed by a description, which gives the apperception or appraisal “a linguistic expression in accordance with instruction.”

If now we take the psychological apperception as the basis of a classification, we have two principal forms of the introspective method. In Direct Introspection, the process under observation is apperceived immediately, while it is still present. There are then two possibilities: description may be made at once, or may be deferred to a later time and based upon a remembered apperception. In Indirect Introspection, on the other hand, the process to be observed is recalled, as a memory image, and apperception and description have reference to this representative memory-process. If we tabulate, we get the three following procedures:

- I. Direct Introspection.
 1. Process and apperception occur together. Description is made on the basis of present immediacy.
 2. Process and apperception occur together. Description is made on the basis of remembered apperception.
- II. Indirect Introspection. Process is recalled as memory-image. Apperception is of memory-image, and description is made on the basis of this apperception.

¹⁰ *Text-book*, 1910, 19 f.

This appears to be, essentially, a classification in terms of what I have called 'attention.' In practice, however, indirect introspection and the second form of direct introspection are likely to run together; and it is therefore more useful to classify on the ground of 'record' or description. The description of a conscious process—I am still paraphrasing Müller—may be immediate, or may be mediated by retrospection. In the former case, the subject-matter of description is the observed process itself. The process may perhaps change while the description is still in course, just as a fire-work may change to blue while we are still exclaiming 'What a glorious red!'; but the description attaches, none the less, to the actual process. In the second case, description is made from a representative memory of the process; or from memory of a psychological apperception of the process; or from a combination of these two memories.¹¹ If we tabulate, we have:

¹¹ G. E. Müller, *op. cit.*, 68 ff., 81 ff. Esp. 69 (cases in which a psychical process or part-process is *beurteilt oder kommentiert* from the psychological standpoint are cases of conscious psychological apperception); 70 f. (various levels of psychological apperception); 86 f. (in all cases of introspection, a conscious state or a complex of states is judged [*ein Urteil gefällt wird*] from the psychological standpoint); 87 notes (negligible cases) · 88 (*die Beurteilung, welcher die Beschreibung einen vorschriftsmässigen sprachlichen Ausdruck gibt*).

So far as I can judge, my own terms 'attention' and 'record' cover the procedure that Müller characterises as psychological apperception and description, with the difference that Müller is speaking in the concrete, while my treatment is abstractively analytical. If we have recourse to formulas, Müller's method is (*psychological apperception*) → *description*, and mine is *psychological (attention, record)*. Müller, in other words, emphasises the empirical unitariness of the particular introspection, and thus includes under apperception things that I should refer to psychological *Aufgabe* and to record. Müller's statement is, however, so brief that I cannot be perfectly sure of this interpretation.

I am inclined to think that, wherever in this discussion Müller uses the term memory (*Erinnerung an*), he has in mind a reproduction in kind, a representative memory. This is certainly intended when the memory of the conscious state or process itself is spoken of; cf. the phrases in *der Erinnerung wieder vergegenwärtigen* and *Erinnerungsbild* on p. 65 (description of an external object). I think that it is also intended when an apperception is said to be remembered: cf. the *vergegenwärtigt* of p. 68, and the instances given, pp. 65 f. In the latter case, however, I imagine that a symbolic memory would serve the purpose.

Münsterberg (*op. cit.*, 170) rules out 'pseudo-memory by verbal description' altogether. His point of view in this passage is, however, different from that of Müller, and I see no reason why he should

- I. Immediate Description, on the basis of immediacy of process and present apperception.
- II. Retrospective Description:
 1. On the basis of present apperception of a memory-image of the process;
 2. On the basis of a remembered apperception, which itself occurred when the process was given;
 3. On the mixed basis of these two memories.

At this point Müller introduces an important distinction,—the distinction of free and controlled consciousness. A conscious state or process is free when it is neither evoked nor influenced by the intent to observe; it is controlled when it arises under the influence of an introspective intent and as the object of a consequent attention especially directed upon it. We have, plainly, no right to generalise a priori from the controlled to the free; whenever generalisation is made, it must be justified by a statement of its methodological grounds. Nor is the line of division, in every case, easy to draw; we may slip insensibly, as we make our instructions more and more precise, from freedom to control. On all accounts, then, and whatever be the phase of introspection that we are examining, the distinction of free and controlled consciousness must be borne explicitly in mind.¹²

The distinction thus drawn must not be confused with that contained in the old-time objection to experimental psychology, that observation in the laboratory is observation under artificial conditions, and can therefore tell us nothing of the real mind.¹³ For the disjunction real-artificial is not identical with free-controlled; and free consciousnesses may be studied in the laboratory not only as well as, but even better than they can be studied in everyday life.¹⁴ Nor must the distinction be confused, again, with that of 'spontaneous' and 'voluntarily aroused,' which the studies of mental imagery have made familiar; for an image, though it rise spontaneously, may be made by

not accept Müller's 'remembrance of an apperception' as a factor in psychological method. On the other hand, Münsterberg believes that introspection is impossible without a previous knowledge of anatomy and physiology (*op. cit.*, 160, 164). Here I cannot follow him.

¹² *Op. cit.*, 73, 79, 95, 98 f., 120. The passage 98 f. describes a case in which generalisation is, within certain limits, permissible.

¹³ See, e. g., J. M. Baldwin, *Handbook of Psychology: Senses and Intellect*, 1890, 30; H. Münsterberg, *op. cit.*, 234; O. Külpe, *op. cit.*, 12; W. Wundt, *Logik*, ii, 2, 1895, 175; J. McK. Cattell, *Psych. Rev.*, iii, 1896, 141. The distinction drawn by Müller is, again, not the same as Münsterberg's classification by natural and artificial (i. e., experimental) conditions: *op. cit.*, 149 f., etc.

¹⁴ It is therefore unfortunate that Müller uses the terms 'natural' and 'constrained.' The antithesis of natural is unnatural or artificial; and, as Müller expressly says (*op. cit.*, 73 note), the constrained processes are by no means unnatural.

instruction the object of a particular attention, and in so far is a controlled process.¹⁴

The distinction must be observed by all those psychologists who use the phrase 'mental process' or 'mental phenomenon' as identical with, or inclusive of, what the older psychologies term 'conscious contents.' Introspection of a free consciousness may demand, for instance, the description of processes at various levels of attention.¹⁵ The distinction seems to lapse, on the other hand, for all those who, with Stumpf, regard conscious contents or 'phenomena' as in principle independent of the function of 'perceiving' or 'remarking' or 'taking notice.' All that remains of it, if I read Stumpf correctly, is a difference of degree in the function itself,—a difference, as he figuratively expresses it, in the amount of consciousness directed toward (*die Ansammlung von Bewusstsein gegenüber*) a particular phenomenon. I cannot, of course, enter here upon a criticism of this other distinction, of act and content, function and phenomenon.¹⁶ It is, however, worth noting, as a sign of the immaturity of psychology and of its imperfect separation from philosophy, that the empirical difference of free and controlled consciousness is dismissed, in certain modern systems, by a wave of the epistemological wand.

3. *Consciousness as the Object of Introspective Description*

Let us assume, for the purposes of the present argument, that Müller's schema of introspection is both adequate to and applicable by a descriptive psychology. Müller is writing primarily, of course, with reference to the special psychology of Memory; and he finds it necessary, even in this restricted field, to supplement the bare statement of method by a long list of cautions and regulative maxims. The main points of his exposition may lay claim, nevertheless, to general psychological validity.¹⁷ I assume, therefore, that in introspection we are describing a conscious process at first hand, or describing at first hand the representative memory of a past process, or describing from memory the way in which we 'placed' some past process at the time of its occurrence. And I assume, further, that we have the skill to make

¹⁴ The distinction runs through the 'literature' of imagery, from G. Cardano in the sixteenth century to G. H. Betts in the twentieth. On the control of a spontaneous image cf. Müller, *op. cit.*, 78 f.

¹⁵ I have shown elsewhere how my own formula deals with this case. See *Attention as Sensory Clearness*, *Jour. Philos. Psych. Sci. Meth.*, vii, 1910, 180 ff.

¹⁶ I have discussed certain aspects of the distinction in *Thought-processes*, 1909, 41 ff. The act-psychology seems to me to reach its *reductio ad absurdum* in S. Alexander's *Foundations and Sketch-plan of a Conational Psychology* (*Brit. Jour. Psych.*, iv, 1911, 239 ff.), which swings us from the *vis representativa* of faculty days to the opposite pole of conation.

¹⁷ Müller himself writes (*op. cit.*, 63) that his "general account of the nature and forms of introspection, and the principal formulae and rules given in the course of the discussion, are to be regarded as generally valid."

this description in psychological terms and to keep it within psychological limits. Now the question arises: What are the categories of description? or, in other words: What is consciousness as describable object?

The categories of description, I should reply, are the last terms of analysis, the elementary processes and their attributes; and consciousness has been described when analysis is, qualitatively and quantitatively, complete. This reply I take to be formally correct. In practice, it needs a twofold qualification: for, first, psychologists are not yet at one as regards the nature and number of elementary processes and their attributes; and, secondly, psychology is not yet able to cope, in thorough-going analytical fashion, even with a moderately complex formation, to say nothing of a total consciousness. Both points are illustrated by the recent work upon Thought. In this field, experimental evidence is offered for a new elementary process, a thought-element, with its own attributes and its own laws of connection; while at the same time there is fairly general agreement that the observational methods at present available are not adequate to a full description of the thought-consciousness. The qualifications do not, however, affect the formal accuracy of the original statement.

We are here upon highly debatable ground. I therefore add, even at the risk of threshing old straw, brief comments upon the terms employed in the above paragraph; and I discuss certain corollaries that follow from my attitude to the question which it seeks to answer.

The Need of Analysis.—It would be unnecessary to insist upon the primary necessity of analysis, were it not that protest is often raised against the analytical treatment of consciousness and the resulting 'atomistic' psychology. Ebbinghaus has met this protest in a form which deserves to become classical.¹⁰ I shall not repeat his argument, but I will supplement it by reference to two concrete cases. The psychologists who have stood most emphatically for the continuity of consciousness are, I suppose, Ward and James. "Mind," says Robertson, "has the character—a character adequately brought out only by Dr. Ward among psychologists—of continuity as its most prominent, salient feature."¹¹ Yet the first chapter-heading of Ward's *Psychology* is 'General Analysis.'¹² James' chapter on The Stream of Thought, which has already become a classic upon the anti-atomistic side, posits the fact that "thinking of some sort goes on." Its author then proceeds: "How does it go on? We notice immediately five important characters in the process." And this discrimination of characters is

¹⁰ H. Ebbinghaus, *Grundzüge der Psychologie*, i, 1897, 164 ff.; H. Ebbinghaus and E. Dürr, *ibid.*, 1911, 177 ff.

¹¹ G. C. Robertson, *Elements of Psychol.*, 1896, 16; cf. the author's own continuation (17): "science is insight by way of analysis."

¹² J. Ward, *Encycl. Brit.*, xxii, 1911, 548.

obviously an instance of that mode of analysis which James later terms 'the process of abstraction.'²²

There is no doubt, then, that a descriptive psychology must be analytical. But objection may be taken to the way in which the descriptive psychologist formulates the problem of analysis. Stratton, for instance, rejects the chemical analogy; "we may name the elements to perfection, without a perfect description of the active whole;" "description is more than a statement of elements and their proportions; other relations and modes of interconnection are important."²³ I am not sure that a 'perfect' description can ever be attained.²⁴ I believe, however, that many of Stratton's *desiderata*—the 'architectural features' of consciousness, the 'manner of behavior' of the constituent processes—would be supplied by an exact description in attributive terms. If the result is still unsatisfactory, it is surely an open question whether description is at fault or whether we are not demanding of description more than it can, by its very nature, give us; whether, that is, our craving for explanation has not led us to cast unmerited reproach on a non-explanatory or pre-explanatory method. Or again, objection may be taken to the results of analysis. Thus Ogden, in reviewing an analytical study of the consciousness of Belief, remarks: "One might imagine that Okabe's results would apply equally well to a description of the aesthetic attitude, the ethical attitude, the consciousness of understanding, or indeed any other of the higher apperceptive states of mind."²⁵ I do not myself think that description, even in its present immature condition, is so ill bested. Let us assume, however,—still for the argument's sake,—that an accurate description of 'the higher apperceptive states' fails to discriminate belief from understanding, the moral from the aesthetic judgment. The inference would be, simply enough, that our current differentiation of these consciousnesses is a differentiation of import or value, or in other words that it transcends description. But if this is the fact, it is to our advantage to know it,—while it is foolish to blame the descriptive method for stopping short with description.²⁶

²² W. James, *op. cit.*, i, 1890, 224 f., 505. The discussion of the Stream of Thought is, in many passages, highly analytical.

²³ G. M. Stratton, Toward the Correction of Some Rival Methods in Psychology, *Psych. Rev.*, xvi, 1909, 75, 80, 84.

²⁴ Cf. Description *vs.* Statement of Meaning, this JOURNAL, xxiii, 1912, 166.

²⁵ R. M. Ogden, Imageless Thought: Résumé and Critique, *Psychol. Bulletin*, viii, 1911, 194. A closer study of the data will, I believe, show that Ogden's imagination has misled him. In any case, the descriptive psychology of these 'higher' processes is still only in the pioneer stage.

²⁶ I suspect that the neglect of Müller's distinction of free and controlled consciousness is responsible for much of the current dislike of psychological analysis. The 'elements' of our text-books are clear-cut affairs, processes isolated from context and set in the high light of attention. It is true that we speak also of laws of connection, and discuss the phenomena of contrast, of fusion, of inhibition, and the like. Yet when we say that a given consciousness is made up, *e. g.*, of kinaesthetic sensations, the reader is apt to think of the kinaesthetic sensations described under that heading in the books, of kinaesthesia focalised and abstracted. But if he tries in this way to synthesise a free consciousness by the juxtaposition of controlled elementary processes, it is no wonder that he comes out with an artificial mosaic which

Process and Function.—Arguments of this sort, however, move only on the surface of things. If we wish to go deeper, we must be clear, first of all, as to what we mean by the term 'process.'

The experimental psychologist, if I understand him, means by process something more than the abstract form of occurrence in time; so that when we say, *e. g.*, that perception is a process, and speak on the other hand of the process of growth, or the process of decay, we are using the word in different meanings. A process, in the psychological sense, is an item of experience to the nature of which durativeness (if the word may be pardoned) is integral and essential. It is true, in the large, that all experience is temporal. Yet there are numberless cases in which the progress of experience is so slow that its process-character may be ignored; we then speak of 'things.' And there are other cases in which the progress is too fast for direct temporal apprehension; we then speak of 'events.' Now it is characteristic of consciousness that its constituents are typically processes. We may find analogies in such experiences as a thunder-storm, a luncheon, an address: here is plenty of content,—heat and rain, thunder and lightning; things to eat and things to drink, speeches and table decorations; topics discussed, introduction and peroration: but it is of the essence of the experience that it occupies a certain, limited time; and its description implies constant reference to this durative attribute. So it is with consciousness. Process is a relative term; and there are times when a conscious complex is relatively so stable that we are justified in applying to it the older term 'state of consciousness' or the more modern 'conscious formation';²⁷ just as there are times when the stream of thought is so rapid that we speak of conscious 'events' or 'occurrences.' Nevertheless, Wundt and James are absolutely in the right when they emphasise the 'going on' of thought or of idea; our descriptions of consciousness, if they are to be satisfactory, must be through and through temporal; our vocabulary must be rich in words that indicate the passage and course of time.²⁸

Only, once more, the psychological process is not the bare form of temporal occurrence. An experience of perception is, as I have insisted, a durative experience; it is not identical with the percept, the *perceptum*. But neither is it identical with perceiving. This 'act' or 'function' of perceiving is, in my judgment, a logical or epistemological abstraction from the concrete experience; it is not an empirically discriminable feature of perception. And in the same way the static percept, in so far as it is psychological,—in so far, that is, as it stands for conscious content, and not for a thing of common sense or an object

bears small resemblance to the continuum that he is seeking to reproduce. And then arise misunderstandings like that of H. J. Watt, who believes that the 'notion of process' has, in my *Thought-processes*, exercised a 'solvent action upon the precisely definable elements of *The Psychology of Feeling and Attention*' (*Mind*, N. S. xx, 1911, 109, 112).

²⁷ H. Ebbinghaus, *op. cit.*, i, 1897, 163 f. The passage has disappeared from the edition of 1911. I cannot but regret the systematic changes which Dürer has thought it necessary to introduce into the first volume of the *Grundsätze*. Ebbinghaus had thought things through for himself, and would not, I am sure, have approved of some of these changes. Cf., however, the Editor's preface, xi ff.

²⁸ I am aware of the summary character of these remarks; and I realise that there is need of a thorough-going historical and critical discussion of our current psychological terms.

of natural science,—is also an abstraction from experience, not empirically discriminable. In other words, it is impossible, by introspective analysis, to break up a perception into perceiving and percept; for that, observation must give place to logic. We may, of course, seize upon some particular moment of perception, which we regard as typical of the whole course, and may be content to describe it and to neglect the past and future, the rise and fall of the total process. For purposes of elementary instruction, more especially, this substituting of the snapshot for the moving picture may be advisable or necessary. But we must still make it clear that what we are describing is a phase of the perception,—not the perception itself, nor yet the percept abstracted from the perception.

In this whole matter of the process, the precept of experimental psychology has been better than its practice. The concept, in Wundt's hands, did yeoman service against the logical statics of associationism. But the analytical work of the laboratories has tended, I think, toward a psychological statics; the temporal aspects of our subject-matter have been unduly neglected. And logic, as if in revenge, has entered psychology by another door, and offers the Stumpfian functions of noticing and classifying, of conceiving and judging, of emotion and appetite, as *Erlebnisse* to be taken account of in any complete description of the 'immediately given.'²²

The Data of Observation.—As against this view of Stumpf's, I agree with Münsterberg that "what are called inner activities are in fact only contents of consciousness;"²³ though for reasons already given I prefer the term 'content-processes' to the bare 'contents.' We cannot observe an experiencing; we are not called upon, in psychology, to observe an experienced; what we observe is experience.

The 'limitations' of introspection now follow of themselves; they are given with its definition; they are of the same sort as the 'limitations' of a microscope or a camera. We can observe only what is observable; and we cannot observe any product of logical abstraction. We cannot, therefore, observe relation, though we can observe content-processes that are given in relation. We cannot either observe change, though we can observe changing content-processes for so long a time as attention, under the observational *Aufgabe*, may be maintained. We cannot observe causation, though we can observe content-processes that are definitely conditioned. And so it is in other cases. Psychological description can deal only with content-processes under their empirically distinguishable attributes.

In practice, however, description and explanation, or description and inference, are likely to be intermixed and interchanged in the most various ways.²⁴ It is, indeed, by this continual shift of standpoint that science advances: and I am pleading neither for rigidity of method nor for pedantry of exposition, but only for clear thinking as the work of system-making goes on. When Stratton says that "a host of real relations apply to mental data, without necessarily having any conscious presence or representatives among these data,"²⁵ I heartily agree; a

²² C. Stumpf, *Erscheinungen und psychische Funktionen*, 1907, 6 f. A succinct account of the 'objects of introspection,' regarded not as content-processes but as contents and processes, is given by A. Messer, *Empfindung und Denken*, 1908, 74-78.

²³ *Op. cit.*, 170; cf. *Grundsätze d. Psychol.*, i, 1900, 230.

²⁴ Cf. p. 486 above.

²⁵ *Op. cit.*, 82. Cf. my *Text-book*, 1910, refs. to *Predisposition*.

competent experimenter will note the relations. When, however, Stratton continues: "and we must make use of these relations in our psychological description even when we cannot find them there as 'elements' in the fact we would describe," I as positively demur; you cannot describe what you cannot observe; your mention of the external conditions introduces a factor of interpretation, which has nothing to do with psychological description. To add interpretation to description is both human and scientific; to call the result a 'psychological description' is to confuse issues. I find this confusion repeated in the following quotation from Judd. "Once the possibility of recognising a wholly different type of *explanation* is admitted, the conscious process [of perception] will be treated as a complex *made up* of sensory elements and other processes which are functional in character and deserving of a separate treatment. We shall then see that any particular phase of experience may be *described* either with reference to its sensory facts or with reference to its functional phases of activity."³³ But to ascribe 'functional activity' to experience is to interpret it.

The Psychology of Logic.—We are concerned, in this paper, with a right understanding of the introspective methods; and for that reason emphasis has been laid upon the difference between description and explanation. We have now to take account of a fact that renders their confusion, in psychology, as natural as it is dangerous: the fact that there may be a descriptive psychology of logical operations. Münsterberg prefaces his account of psychological method with the remark that "every investigation set on foot by a special science presupposes the universal logical functions, and no psychological method can yield its full fruit whose user fails in ability to form judgments, concepts, inferences, to develop his thoughts inductively and deductively, to formulate classifications and demonstrations."³⁴ That is the side of the shield to which we have so far given our attention. But Ward's statement is equally true,—that "the whole choir of heaven and furniture of earth' may belong to psychology;"³⁵ the domain of psychology is as wide as individual experience. While, then, psychology presupposes logic, it may also consider logic from its own point of view; it may, in particular, furnish an introspective account of the content-processes that correspond to logical operations.

I said that this fact makes it natural for the psychologist to confuse description and explanation, fact and meaning. For, on the one hand, it tempts him to hypostatise the abstractions of logic; to invent content-processes of relation, of judgment, etc., and in this way to secure

³³C. H. Judd, *What is Perception?* *Jour. Philos. Psych. Sci. Meth.*, vi, 1909, 41. The italics are mine.—To prevent a possible misunderstanding, I will here state explicitly that I hold no brief for sensation, and do not aim to reduce the content-processes of descriptive psychology to the type of sensation. If the advocates, *e. g.*, of the thought-element can demonstrate a new content-process, I am ready to accept it. More than this: I sincerely welcome any phenomenological term or phrase (such as 'conscious attitude') that challenges to psychological analysis. I note a challenge of this sort in the 'purely dynamic process' found by M. Wertheimer in his recent study of seen movement (*Zeits. f. Psych.*, lxi, 1912, 245).

³⁴*Aufgabe und Methoden*, 145. Wundt says the same thing in his essay *Ueber psychologische Methoden*, *Philos. Studien*, i, 1883, 3; cf. *Die Aufgaben der experimentellen Psychologie*, *Essays*, 1906, 206 f.

³⁵*Op. cit.*, 548.

a phenomenological agreement of psychology and logic.⁶⁶ And, on the other hand, it may blind him to real psychological problems. There will, for instance, be few psychological descriptions, of any length, in which the term 'greater,' or some more specific equivalent, does not occur. We are so much accustomed, in adult life, to the comparative form of the adjective, that this 'greater' may well pass for a descriptive word. Yet in strictness it is, as psychophysical usage rightly declares, the expression of a judgment of comparison; so that the psychologist who accepts it as part of the currency of description overlooks one of the problems that is set by logic to psychology.⁶⁷

Recapitulation.—We asked the question: What are the categories of psychological description? or: What is consciousness as describable object? The foregoing paragraphs touch, in the barest way, upon the points which arise as we seek to answer this question. Descriptive psychology must begin with analysis, because analysis is the first task that a given subject-matter assigns to science. The terms of description must be content-processes, because consciousness proves, as we observe it, to be made up of content-processes. At any stage of description, we may bring logic to bear upon our introspective material; but we must not read logic into that material. Finally, a set of accurate descriptions of typical consciousnesses is not a system of psychology; yet, if we may judge by history, there is no short cut to system that avoids the minutiae of description: and while we should make all allowance for differences of temperament, and should recognise every honest effort to further the understanding of mind, we must neither mistake temperamental impatience for reasoned argument nor tire of plodding the low *posteriori* road of observation.

4. *The Introspective Method as applied to Thought*

At this point of the enquiry, it seems advisable to put our conclusions to a practical test. Experimental introspection, we have said, is a procedure that can be formulated; the introspecting psychologist can tell what he does and how he does it. If, now, we seek to formulate the method, in a concrete case, we shall be the better able to judge the value of Müller's schema; we can make such additions and qualifications as may prove to be necessary; we pave the way for

⁶⁶ Stratton (*op. cit.*, 81) rightly complains that "relational elements, feelings of relation and the like are often in effect conceived as but one more material or ingredient added to the rest." When he adds, however, that "the account then pursues the evil course of describing a mental fact by attention to its stuff and materials only," he seems to me to miss the point of his own objection.—The same protest against hypostatisation of inferences forms a *Leitmotif* of Judd's essay on Perception, to which I have referred above.

⁶⁷ The problem overlooked is in fact twofold, descriptive and genetic. For the psychologist must not only describe the content-processes which, in the particular case, are the vehicle of the judgment; he must also trace the course of development from 'absolute impression' to true 'comparison.'

a detailed consideration of sources of error; we shall perhaps be able to detect and to eliminate spurious forms of experiment. And there are obvious reasons why the processes of thought should furnish the illustration required. I take the investigations in the order of their appearance.

(1) Marbe, in his study of Judgment, makes the method very simple. In order to experiment upon judgment, "one has merely to bring it about that the observer experiences the kind of judgments required, and to ask him to describe his experiences (*Erlebnisse*) immediately after the judgments." Thus, in a special case, the observer "had at once to report (*zu Protokoll geben*) the conscious processes which he had experienced" when the conditions for judgment were completed; moreover, "he was asked not to confine himself, in his description, to the processes that ran their course simultaneously with the perceptions which took on the character of judgment,—since it might possibly be of interest to know what conscious processes introduced the act of judgment."³³ Nothing more is told us. But we may, I think, infer from Marbe's introduction, and from the wording of the reported introspections, that the observers undertook their task in a definitely psychological spirit: a phrasing of experience in familiar psychological terms seems to have been expected by the experimenter and intended by the observers.³⁴

(2) Watt, it will be remembered, has six problems, which are formulated in the ordinary logical way: to find a superordinate, subordinate, coördinate concept, and to find a whole, a part, another part of a common whole. He says very little of his method.³⁵ "After every experiment, the observer reported everything that he had experienced and everything that he cared to say about his experiences. All this was at once written down by the experimenter, and was occasionally supplemented by appropriate questions." "The report depends upon the observer's conscious contents, which he described and expressed in words as quickly as might be."³⁶ Watt's aim was rather explanatory than descriptive; and he therefore appears to have preferred a phe-

³³ K. Marbe, *Experimentell-psychologische Untersuchungen über das Urteil: eine Einleitung in die Logik*, 1901, 93, 16, etc.

³⁴ Cf. Marbe's later statement: "I have supposed that what is done in these experiments is, in general, to bring out in the observer, by fitting prearrangements, experiences of some particular kind, and then at once to evoke judgments regarding these experiences" (review of E. Dürr, *Erkenntnistheorie*, *Zeits. f. Psych.*, lx, 1911, 121 f.). A complete account of introspective procedure demands, in Marbe's opinion, "a thorough-going, many-sided, perhaps somewhat tedious experimental enquiry" (*ibid.*).

³⁵ H. J. Watt, *Experimentelle Beiträge zu einer Theorie des Denkens*, *Arch. f. d. ges. Psych.*, viii, 1905, 289 ff. Inferences may be drawn from the sections 316 ff., 332 f., etc.; but I am here concerned only to discover how the author himself conceives his method,—not to interpret the observers' reports. Interpretation, if it is to carry conviction, must be based on a special experimental study, like that of which Marbe speaks.

³⁶ *Ibid.*, 289, 423. Cf. 426: the report, in psychological experiments, is not exhaustive.

nomenological to a strictly psychological report.* There is, undoubtedly, a change of attitude, as one passes from Marbe to Watt.

(3) The aim of Ach's method of 'systematic experimental introspection' is to secure "a complete description and analysis" of the experimental consciousness. The observer is instructed "to give in the after-period a detailed description of the processes experienced in the fore and main periods;" the intent to observe thus bears upon the contents of the after-period, and helps to throw them into clear relief, while it does not interfere with the consciousness of the two preceding periods. The ideas of the after-period are conditioned upon perseverative tendencies; they are not memory-images, but rather memory after-images; they may remain clear for several minutes. "At the beginning of the after-period, the observer frequently has a peculiar consciousness of what he has just experienced. It is as if the whole experience were given at once, but without a specific differentiation of contents. The entire process is, as one observer put it, given as if in a nutshell. The particularities of the process then emerge, clear and distinct, from this matrix. . . . The attention may be turned now to this now to that part of the perseverating contents, so that the simultaneous and successive portions of the experience can be subjected to a thorough-going analytical dissociation and description." Completeness of report is further guaranteed by question and answer; there is "a continual and intimate exchange of thoughts between observer and experimenter;" "the experimenter plays a more prominent part than in any other psychological method."† However, as practice increases, and

* Cf. 345, note 2, where an observer is taken to task for reporting in terms of a systematic psychology; and the section on the insufficiency of consciousness, 423 ff.—I select some typical remarks. (1) It is dangerous to argue from absence in report to absence of conscious contents. For there may be nothing present in consciousness, at the moment of introspection, to reproduce the particular experience; or what is present may simply be unable to reproduce it; or the *Aufgabe* of description, though operative, may not be sufficiently active; or the observer may not have reported all that he might have reported: 427. (2) Relations and delimitations are not given, as such, for description; their report demands special *Aufgaben* of explanation and comparison: 428 f. (3) Current 'descriptions' of certain higher processes are largely colored by theory, or have been made up in accordance with probabilities: 435.

† N. Ach, *Ueber die Willenstätigkeit und das Denken*, 1905, 8 ff. The following points may also be noted. (1) Perseveration is favored by attention, practice, and intent to observe: 10 f. (2) Both observer and experimenter must strive for completeness of description; the experimenter must therefore keep close watch upon the forms of expression used by the observer: 13 f., 16. (3) Disadvantages of psychological observation are: the need of a constant control of the terms of report, if description is to be adequate; the necessary assumption that a perseverating experience is identical with its original; the difficulty of reestablishing exact conditions; the very great difficulty of complete description: 15 f., 16 f., 20. (4) Great care must be taken that questions put by the experimenter are not suggestive: 17 f. (5) Temporal order must sometimes be sacrificed, in order that transient processes may be grasped and analysed: 19. (6) Practice favors description; so that part-processes which received but little attention in the original experience may stand out in the perseveration: 19 f. (7) Defects of the method of systematic experimental introspection, in its

the observer's vocabulary becomes fixed and precise, this feature of the method loses in importance."

Müller criticises the method thus described by Ach on four principal grounds. It is, he says, dangerous, for several reasons, to have free recourse to question and answer. It is out of the question that the introspective report of a fairly complicated consciousness should be even approximately complete. The perseverative tendencies are selective and, at times, misleading; and we have no proof that they are strengthened by the intent to observe. Finally, it is dangerous to suggest to the observer that the contents of the after-period are identical with those of the experimental consciousness; we know of cases to the contrary; and the observer should therefore be instructed to report only such experiences as he remembers, with assurance, to have occurred during the experiment."

present form, are: unequal duration of experiments, and of interval between experiments; occasional disturbance of an experiment by the after-effect of a foregone analysis: 22 f. (8) A control of introspection by variation of external conditions is essential: 16, 20 f., 25.

"*Ueber den Willensakt und das Temperament*, 1910, 7 ff. Questioning is necessary so long as observers are unpractised and terminology is unsettled; under the most favorable conditions, it "retires wholly into the background:" 8 f. Ach's 'awareness' (*Bewusstheit* = *Gegenwärtigsein eines unanschaulich gegebenen Wissens*) was discovered by questioning: "erst durch das Eingreifen des Fragen stellenden Versuchsleiters wurden diese Erlebnisse aufgedeckt und dann bei jeder Versuchsperson nachgewiesen." For the rest, questions cannot be harmfully suggestive if the method of systematic experimental introspection is given an experimental setting "which permits a quantitatively variable graduation of the causal conditions and a genetic-synthetic construction of the phenomena:" 9, 15, 17.—Ach again insists on completeness of analytical description, and urges that fractionation (Watt, *op. cit.*, 316 ff.) must be applied with great caution: 11.

"G. E. Müller, *op. cit.*, 137 ff. A. Michotte recognises that "the data of memory are fatally incomplete," but thinks that the experimental conditions are, nevertheless, extremely favorable to reproduction. He believes, with Müller, that "questions like those put by Ach are not allowable" (A propos de la "Méthode d'Introspection" dans la psychologie expérimentale, *Rev. Néo-Scholastique*, iv, 1907, 522 f., 525 f.). G. Deuchler criticises both the demand for complete description and the use of questions. Not only is questioning dangerous; it is also, at the best, of little value; for it increases the number of analytical results without enhancing the delicacy of analysis (Beiträge zur Erforschung der Reaktionsformen, *Psych. Studien*, iv, 1909, 380 ff.). These references are given by Müller. E. Westphal defends Ach's method: a 'complete' report means simply a non-selective report, an account of all that the observer can remember; and questions, dangerous as they are, are still under certain circumstances unavoidable (Ueber Haupt- und Nebenaufgaben bei Reaktionsversuchen, *Arch. f. d. ges. Psych.*, xxi, 1911, 432 ff.). Reichwein, on the other hand, anticipates much of Müller's criticism. Questioning is always dangerous (*op. cit.*, 77); reports are almost inevitably incomplete (58, 110, 133); the play of attention upon perseverating contents may introduce personal interests and prejudices (76). Reichwein points out that Ach's nutshell revival is a *Bewusstheit*, an awareness (103); and a comparison of the relevant passages in the *Willenstätigkeit und Denken* (11 f., 210 f.) confirms the remark; the after-period opens with a *Bewusstheit*,

(4) Messer gave his observers a long series of problems, some of which called for thought of 'objects,' and others for thought of 'concepts.'⁴⁴ The observers were instructed, "as soon as they had uttered the reaction-word, to report everything that they had experienced from the appearance of the stimulus-word up to the moment of reaction." Questions were employed but sparingly, and with care to avoid suggestion.⁴⁵

Messer is expressly concerned with the nature of the introspective procedure; he wishes to discover "what is actually going on in the observer while he makes his report." "The observers were often required, at the end of their report of an experience, to state what they themselves had experienced while they were giving the report." He finds two main types of description. In some cases, "the experience just had is past, of course, and yet in a certain peculiar sense is still present; it is, so to say, arrested for examination;" here we have Ach's perseverance, or Lipps' direct recollection. In other cases, there is need of 'reflection'; the experience is 'reproduced' for examination; here we have Lipps' indirect recollection. Between these stand intermediate cases, in which recollection is direct, but reproductions "appear as it were of their own accord, as concomitant phenomena."⁴⁶

out of which the 'perseverating ideas' are explicated. But how then does Ach know that these ideas are really 'perseverative,' and not an imaginative reconstruction on the basis of the awareness? Finally, Wundt, writing in the same year as Michotte, passes negative judgment on Ach's use of questions (Ueber Ausfrageexperimente und über die Methoden zur Psychologie des Denkens, *Psych. Studien*, iii, 1907, 338 ff.). "Eine Frage ist an und für sich eine Beeinflussung, sie mag so vorsichtig wie möglich eingerichtet sein. . . . [Der Fragende] mag noch so vorsichtig sein, nach irgend etwas muss er doch fragen."

⁴⁴ A. Messer, Experimentell-psychologische Untersuchungen über das Denken, *Arch. f. d. ges. Psych.*, viii, 1906, 4 ff. I have already noted the logical formulation of Watt's problems; I note here that Messer's distinction seems calculated to bring in the stimulus-error. "This distinction is meant, of course," Messer says, "to carry a psychological meaning simply; the differences to which it points are differences merely in the thought-experience:" 149. That the differences are not psychologically self-evident is proved, however, by the fact that "not all observers were able to perceive them:" 150.

⁴⁵ *Ibid.*, 12.

⁴⁶ *Ibid.*, 14 ff.; T. Lipps, Bewusstsein und Gegenstände, *Psych. Untersuchungen*, i, 1905, 39 ff.; *Leitfaden der Psychologie*, 1906, 12 ff., 42 ff. Messer's treatment is schematic: we are not told, e. g., whether the reproductions of the mixed cases are used for the purpose of description, or serve as a check upon the description of the more stable memory after-images, or are just ignored.—The observer's knowledge that he has to report is, in general, favorable to fullness of statement: 17 ff. On this point, Messer furnishes, in Ach's behalf, the evidence that Müller finds to be lacking. Messer, however, has nothing to contribute to Ach's theory of perseverance; his references are to Lipps.—One observer reports: "When I make these statements, the experience (*das Erlebte*) is not always reproduced, though it often comes to that. It is a curious fact that, if statements of this sort have not suggested themselves (*sich bereit gestellt*) at the time of the experience (*mit dem Erlebten*), we know nothing whatever about it:" 16, 21 f. Yet the same observer declares: "There is no actual introspection during the experiment." I have discussed this report in *Thought-processes*, 1909,

(5) Bühler, like Watt, says little of his method. He demanded from his observers "a description, as accurate as possible, of what they had experienced during the experiment." No emphasis was laid upon completeness of report; it was rather desirable that the observers "should give a good account of what, in the particular case, they had seen with especial clearness and knew with perfect assurance." Nor was there any restriction of terms; the observers were allowed to choose their own words, and sometimes were expressly warned against the use of technical expressions. The method requires the intimate coöperation of experimenter and observer; but the coöperation is not secured, as with Ach, by much questioning; questions are employed only under stress of necessity; it is secured rather by empathy, by sympathetic understanding.⁴⁰

So much Bühler volunteers. When the charge of *Kundgabe* and *sprachliche Darstellung* has been laid against him, he admits that "many parts" of his reports are not descriptive; but "one must not forget," he adds, "that I was obliged to report a great deal simply in order to show the connection in which the essential portion of the record stood."⁴¹

(6) The results of the series of studies published from the Cornell Laboratory⁴² may be summarised as follows. First, there can be no doubt that direct memory (Ach's perseverating contents, Fechner's memory after-images) plays a part in the reports. In general, however, this part is intermittent: that is to say, a certain passage of the original experience will reappear in the after-period in direct memory, while the passages that precede and follow are reproduced in the ordinary way. We have never had any clear instance of Ach's total rein-statement. And it seems that the passages which thus stand out, in direct memory, are always passages which, in the original experience,

239; I mention it here only to emphasise the slipperiness of methodological terms. It is plain that the 'suggestion' was conscious, or the observer could not have reported it.

Reichwein argues that direct recollection can hardly play any large part in investigations of this kind, since thought is teleological and shoots to a conclusion, with the result that the intermediate steps quickly fade from consciousness: *op. cit.*, 40, 110, 115 f., 150 f. He finds in this fact the critical justification of Wundt's second rule of experiment: *Psych. Studien*, iii, 1907, 308.

⁴⁰K. Bühler, *Tatsachen und Probleme zu einer Psychologie der Denkvorgänge*. I. Ueber Gedanken, *Arch. f. d. ges. Psych.*, ix, 1907, 299, 305; 307 f.; 309, 331; 308 f., 313. Bühler finds an 'objective control' of the method in the immanent agreement of the reports and in the results of his experiments upon the memory of thoughts: 306 f. Reichwein thinks that the agreement of reports is, in such cases, inconclusive; the setting of the tasks and the phrasing of the instructions carry a suggestion from the experimenter: *op. cit.*, 56, 67, 74. Only where there is a truly objective control, by time-measurements and by variation of experimental conditions, is the agreement to be trusted: 77. Reichwein also expresses his lack of confidence in empathic interpretation of the reports: 109.

⁴¹Zur Kritik der Denkexperimente, *Zeits. f. Psych.*, li, 1909, 118; cf. *op. cit.*, 318.

⁴²I do not give a list, as all have been printed in this JOURNAL. I have read a number of other articles upon Thought and Volition, all in fact that I could discover, but I have found nothing else of importance that bears on the conduct of the method.

had been 'marked' for report.⁴³ I cannot, however, affirm that there are no exceptions to this rule.⁴⁴

Secondly, there is a tendency, apparently universal, to help out description by formulation of meaning. The tendency is exceedingly strong in the case of relatively unpractised observers. As practice advances, the mode of recall varies. Sometimes (and this is, perhaps, the ordinary procedure) meanings and content-processes alternate; the 'marked' passages of the experience are described, unmarked passages are summed up in a statement of meaning. Sometimes the observer takes his bearings, so to say, in terms of meaning before he begins to describe; the schema of meaning then serves as a support to, and as a check upon, the course of reproduction.⁴⁵ Sometimes, again, if reproduction fails at a given point of the report, the observer will hark back to meaning, and will reconstruct in imagination the content-processes of the original experience: this recourse is not common, but it has unquestionably occurred.⁴⁶ And sometimes the observer will deliberately turn away from meaning, and will set himself to report in the terms of descriptive psychology.⁴⁷

Our experimenters differ as to the legitimacy of appeal to meaning; and such differences of opinion, where the whole method is still crude and imperfect, are only natural. They differ also, thirdly, as regards the propriety of questions. On the whole, I think, we have come to the conclusion that questioning is dangerous; and that, if a special point needs to be cleared up, it is better to work by way of variation of experimental setting and material. At all events, results obtained by questions should be sharply marked off from those derived from the spontaneous report of the observers.⁴⁸

It is evident that these accounts are meagre; it is evident, too, that they contain an unsifted mixture of fact and theory, of exposition and valuation. But let us remember that we are dealing with a method in its formative stage, and that our own present question is not whether the method is valid, but

⁴³ A term which has become current in the laboratory for the 'marking' of a conscious complex by a practised observer is 'noddling to:' "I nodded to that as it came." Here we have a 'psychological apperception' reduced to very low, if not to lowest terms.

⁴⁴ The rule may not be inverted: not all 'marked' passages recur in direct memory.

⁴⁵ This preliminary orientation by meaning may, perhaps, correspond to Ach's nutshell reproduction, which, as we saw, is a *Bewusstheit*, and not a reproduction in kind.

⁴⁶ Müller's *nachprobierendes Vorstellen*: *op. cit.*, 96.

⁴⁷ Including, in this case, the terms of the Würzburg school.

⁴⁸ Ogden and Dodge (see this JOURNAL, xxiii, 1912, 438) must, I imagine, have overlooked the fact that Ach's *Bewusstheit* was discovered by questioning on the part of the experimenter. Ach himself does not think it necessary to make this statement, explicitly, in the *Willenstätigkeit und Denken*, though he comes near it (*e. g.*, 17, 41 note). At the other extreme stands the author of a recent article upon Feeling, who made many experimental observations upon his topic, but has preferred to say nothing about them, and simply to set forth his own theoretical convictions, because the confirmation received from his observers was gained by possibly suggestive questioning.

whether it can be formulated. We shall then find the scarcity of detail and the confusion of standpoints pardonable; and we shall realise that—whatever the prepossessions of the experimenter, and whatever the aberrations of the observer—the procedure followed can be pretty definitely stated. One gets the impression, indeed, that the experimenters, or at least the earlier of them, took the introspective method for granted: they were setting a straightforward task, which the trained observer was competent to perform. The event shows, of course, that the observer is as resourceful in going astray when the thought-processes are under observation as he is in other and better-known fields of experimental work; it shows also that the conduct of the method by the experimenter is by no means a simple matter. This insight, however, has itself depended, in no small measure, upon the communication of the method by those who have employed it; had their accounts been unintelligible or seriously inadequate, criticism must have remained general, and the detection of particular sources of error would have been impossible. The method of systematic experimental introspection, to return to Ach's phrase, has never been set down with the fullness to which we are accustomed in the case of sensation, of after-image, of perception, of memory, etc. And, in so far as this fullness of statement implies the establishment of norms, of definite rules and regulations for experimenter and observer, we must freely grant that, in the sphere of thought, it is as yet unattainable. Yet there can, surely, be no doubt that the practice of the Würzburg school is, in principle, communicable and that the formularies of introspection will some day be as exact for the more complex as they now are for the simpler content-processes.

Meanwhile, a host of questions is upon us. Are the experimental thought-consciousnesses 'free' consciousnesses in Müller's sense, or are they in any sense dependent upon the intent to observe? What is the effect of this intent to observe, in all the various forms that it may take and in all the various settings in which it may appear? May the non-observational methods, such as those of imaginative reconstruction and of communication,—may these non-observational methods be employed, under any circumstances, or must they be strictly forbidden? What are the marks that distinguish direct from indirect memory? What are the lowest terms of a psychological apperception? May it, like the *Aufgabe*, lapse with time into the unconscious? When, if at all, may the experimenter have recourse to questioning?

Questions, these, of very different range; and questions that, in the present state of our knowledge, admit of answer in very varying degree. Many of them have been discussed by Müller, in the work to which we have frequently referred: and the reader may be heartily recommended to that discussion. Some of them I hope to take up in a later paper.

Summary.—There are specific differences of introspective procedure, but all the forms show a generic likeness; introspection always presupposes the point of view of descriptive psychology, and the introspective methods thus do us the same service in psychologising that 'observation and experiment' do in natural science. The generic likeness of procedures allows us to write a general formula for the conduct of introspection; and a strict adherence to the descriptive standpoint allows us to determine the objects of introspection as content-processes. A tentative application of G. E. Müller's formula to the recent experimental work on Thought and Volition confirms the results of the foregoing theoretical discussion, while at the same time it raises a number of further methodological questions.

NEW APPARATUS FOR ACOUSTICAL EXPERIMENTS¹

By M. BENTLEY, E. G. BORING, and C. R. RUCKMICH

Sound-Localisation Apparatus

(Fig. 1)

While this apparatus was originally designed and built for the purpose of localising pure tones, it is, nevertheless, suitable for localising noises as well. It consists, first, of a rod (*a*) of $\frac{1}{2}$ " gas-piping, bent to an arc of 120 degrees of a circle 3 feet in radius. This rod is fitted into a vanadium steel plate, shown at (*b*), which moves noiselessly and readily on a ball-bearing runway above and below it and between two stationary steel plates (*c* and *d*) of the same diameter (4 inches). All three plates are fastened together by means of a bolt, seen at *e*, $\frac{3}{4}$ " in diameter and 6" long, which screws into an angle-plate (*f*) above it. A lock-screw holds the bolt in place. The angle-plate fits the lower end of a 4" x 6" beam (*g*) that reaches to the ceiling of the large room in which the apparatus stands. On the revolving plate which carries the curved rod is fastened a brass disc (*h*) $\frac{1}{16}$ " thick and 6" in diameter. Upon this disc are painted in black on a background of white enamel marks which indicate in degrees of rotation the position of the curved rod in the horizontal plane. A blued steel pointer fastened on the lower stationary plate gives the precise reading. Along the curved rod (*a*), which is also marked in degrees of position in the vertical plane, is fastened a movable and adjustable coupling (*i*). This coupling allows a brass rod (*j*) $\frac{3}{8}$ " in diameter and 4' long, to move radially in and out from the arc and at right angles to the tangent of the arc at that point. The coupling with its brass rod can also be placed in any position on the curved arc; i.e., it can be placed anywhere along the circumference of the circle in the vertical plane. On one end of this brass rod an adjustable clasp (*k*) is fastened. The clamp is primarily designed to hold an electrically operated tuning fork and re-

¹ From the Psychological Laboratory in Arts, Cornell University. With the exception of the pendulum-control for the rhythm-box and a part of the interruptor, fashioned by Mr. Ruckmich, the pieces described have been made from the Department's plans and models by Mr. C. N. Harding, of the firm of Messrs. Kellogg & Harding, 108 North Cayuga St., Ithaca, N. Y.—M. B.

sonator, indicated at *l*, but may hold any other electrically driven device for the production of sound. One electric connection is made with the fork through the metal frame of the apparatus, the other through a flexible lamp-cord to a wheel contact (*m*), moving along an insulated track at the bottom of the supporting beam. This method of connection obviates the difficulty of twisting the connecting wires as the apparatus rotates. Both the weight of the fork and the weight of the revolving curved rod are suitably counterbalanced by means of adjustable counterweights (*n* and *o*). The observer sits in a cushioned chair with his head in a head-rest, seen at *p*. His ears are approximately at the center of the circle of which the curved rod forms an arc, and opposite the open end of the resonance-box. The varying height of observers is accommodated by raising or lowering the chair. In front of the observer's head is mounted a 4 c. p. incandescent light (*q*), seen through the closed eye-lids and operated by the experimenter as a 'now' signal. The connections from the fork pass along the ceiling, and from the signal light through a socket in the floor, to a writing desk (*r*), equipped with a shaded reading-lamp and two switches, one for the fork and one for the signal light. The desk is over nine feet from the observer and the switches mounted on it are noiselessly operated by the experimenter. The connections pass on to an adjoining room separated from the experimenter's room by a stone wall two feet in thickness. In this adjoining room, a Helmholtz exciting-fork electrically driven is set up. It is connected in shunt circuit with the secondary fork and has a vibration rate two octaves below the secondary fork. It was necessary to connect it in a shunt circuit because it was inconvenient to pass into the adjoining room to start the exciting-fork after the operating switch was pulled at the end of every judgment.

The apparatus has, among others, four advantages: (1) it makes possible experimentation with a pure tone, and the avoidance of various secondary criteria, viz., rustling of experimenter's clothing, noise of footsteps, sounds from breathing, etc.; (2) it covers every advantageous point in the tri-dimensional manifold, because the fork can be moved in and out with regard to the observer's ear from proximity to a distance of about six feet;—this outer limit is reached by swinging the brass rod, which carries the fork, around outside of the curved rod that marks the circumferential boundary of the three-foot circle; (3) on account of the noiseless bearing above, where the apparatus is attached to the supporting

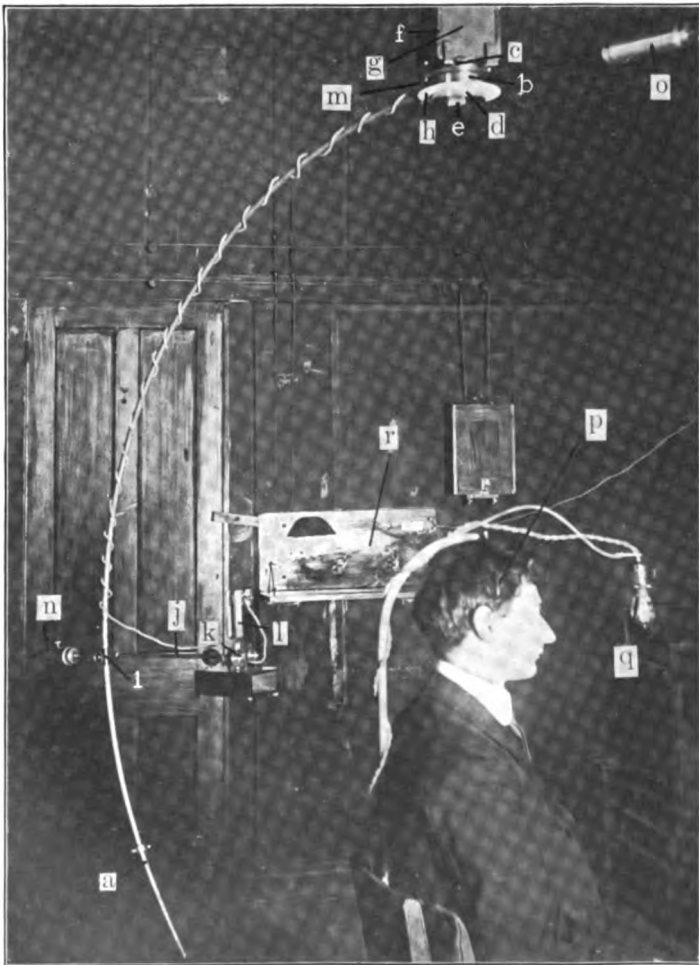


FIG. 1.—Sound Localisation Apparatus.

beam, and because of the impossibility of twisting the circuit wires during rotation, it is suitable for experimentation with a moving stimulus; and (4) inasmuch as there is no mechanical connection with the chair and head rest, disturbances attending the adjustment of the apparatus are not communicated to the observer.

Rhythm Interruptor

(Fig. 2)

This device is a part of the general apparatus used in an investigation of the rhythm-consciousness. It was designed to interrupt the secondary (receiver) circuit of a telephonic system. The demands upon the apparatus were eight in number: (1) The apparatus should rotate at a constant rate of speed, (2) its speed should be variable at the experimenter's wish, (3) its speed should be easily measurable, (4) the apparatus should produce a rapid interruption of a telephonic circuit, (5) during intervals between interruption, there should be the best possible electrical contact, (6) there should be a simple and accurate method of varying the temporal length of intervals of contact and of non-contact, corresponding to the length of members and of pauses between members of a rhythmic series, (7) these periods of contact and of non-contact should be subject to accurate measurement, and (8) both long and short intervals, *i.e.*, those between groups of members and those between members of a rhythmic series, respectively, should be of constant temporal length, regardless of the change in the duration of the individual members of the rhythm. To meet the first requirement, we used an Edison electric phonograph motor, whose speed is regulated by means of a governor as indicated at *d* in Fig. 2. When the speed of the motor tends to increase, this governor introduces a resistance into the circuit and does not break the circuit as is the case with the Helmholtz motor.

At *e* is shown a slide-rheostat by means of which the speed of the motor is regulated in accordance with the second demand. The constancy of speed of rotation is satisfactory for the periods employed. The mean variation for 17 determinations covering a period of 11 minutes was calculated to be .9%. Upon the steel cylinder of the phonograph-record, whose end is seen in the upper left corner of the engraving, is mounted a belt-groove. This groove affords a tight grip for the belt and keeps the belt in place on the cylinder. The belt runs over a pulley which is fastened on a spindle at the

forward end of which are seen the two overlapping cams, *a* and *b*, held in position by means of a knurled nut. This spindle is mounted on a base separate from the motor. The cams are made of $1/32$ " sheet brass, and can be readily replaced by any other type of cam desired. These cams serve as a basis for the interruption of the secondary circuit and for the consequent production of the two-membered rhythm investigated in this experiment. At *c* is seen the lever made of amalgamated sheet copper. This lever is tripped by the cams. To its right is a duplicate lever which may be used when another circuit is to be interrupted in alternation with the first. In this case another arrangement of the cams used becomes necessary. As the cams are shown, *b* is mounted in front of *a* which is approximately a sextant and carries on its circumference a black pointer seen directly above lever *c*. This pointer indicates, upon the graduated arc *b*, the amount of revolution of *b* over *a*. The cams are cut to give a long interval of 180° shown in the upper circumference of *b* and a short interval of 60° represented by the arc of *a*. On either side of *a* as shown and, of course, uniting in front of the arc of *a*, are depressions corresponding to the two members of the rhythm, *i.e.*, stated a little differently, the lower circumference of *b* is a continuous depression, interrupted by the projection of cam *a*. To whatever extent, therefore, *a* is rotated to the right or to the left over the circumference of *b*, to that extent will the temporal rhythm become iambic or trochaic. At the position shown, the rhythm delivered will be approximately a spondee. In this way is the sixth requirement met. The lever dips into a mercury cup, shown beneath it, whenever a depression occurs in the circumference of the cams. This sort of contact is, of course, one of the very best obtainable and meets the fifth condition. In like manner is the fourth requirement satisfied, because, as the cams in their rotation very quickly act upon the shorter arm of the lever, the more quickly is the longer arm lifted out of the mercury. The eighth demand is satisfactorily met by the shape of the cams themselves. Both outer circumferences of these cams are of constant length regardless of their shifting. The requirements as to the accuracy of the measurement of the speed of the motor and the length of the intervals of contact and of non-contact are adequately met by putting in series with the circuit interrupter an electric time-marker together with a time-fork, or other recording apparatus, and a kymograph, or the Hipp chronoscope. There is ample provision for inserting another circuit in which the

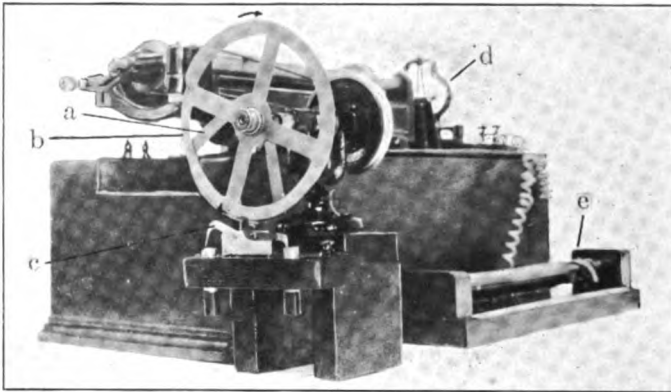


FIG. 2.—Rhythm Interruptor.

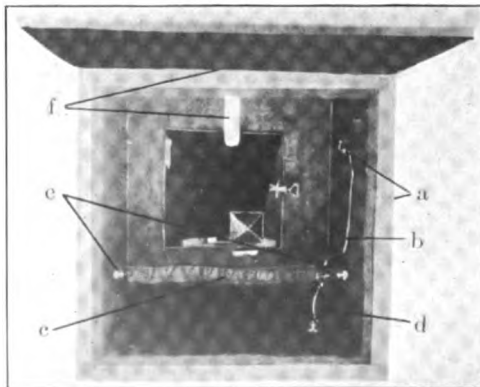


FIG. 3.—Rhythm Box Controller.

second lever may be used, as when a circuit of comparatively high resistance is to alternate with one of less resistance in order to obtain a difference in the intensity of the two rhythm members, or as when a circuit connecting with a source of sound of higher pitch is to alternate with a circuit connecting with a source of sound of lower pitch, in order to obtain differences in pitch between the two members. By the addition of the proper number of cams and by inserting cams of the proper shape, rhythms of a higher order than the two-membered series used in this experiment may be produced.

Rhythm-box Controller

(Fig. 3)

In order to produce an unintensified sound at the beginning of a rhythm series after an interval of no sound by means of a Stoelting rhythm-box, it became necessary to modify the apparatus in the manner shown in Fig. 3. As the apparatus is put on the market, it consists of a square felt-lined box, high enough to contain an ordinary metronome and wide enough to allow the metronome pendulum to execute its widest excursion. The cover of this box is hinged at the back and it is opened slightly and noiselessly by means of a series of connecting rods and a finger-key. After the metronome is started in the box and the cover is closed, a faint ticking is heard until a depression of the finger upon the key raises the cover and intensifies the sound. If, then, there is occasion to start the rhythm series with an unintensified metronome click after an interval of no sound, or if it becomes necessary or convenient to start and stop the metronome clicks at any desired points in the rhythm series, recourse must be had to a device that will start and stop the metronome when the cover is closed.

The view in the photo-engraving is from above. The metronome stands on a piece of heavy harness-felt in which a triangular hole is cut to receive the three feet mounted on the base of the metronome, thus to insure the accuracy of its position. In front of the pendulum is a padded brass rod (*e*), pivoted at *e*, in shape like the wire of a long package-handle. At the right before it bends down to its pivot, a steel tension spring (*d*) is attached and fastened in the same plane to the front side of the box. At this place, also, is pivoted a rod (*b*) which connects the padded brass rod (*c*) with the operating lever (*a*). This rod (*b*) is bent the right to avoid interference with the swinging of the metro-

nome pendulum. The operating lever (*a*) passes through the side of the box and pulls against the spring (*d*). When moved toward the back of the box, it causes the padded brass rod (*c*) to press against the metronome pendulum, and when given an additional downward thrust past its own 'dead-center' it locks the device. At *f* is indicated a rubber-covered steel spring and protecting pad. These are attached to relieve pressure and to avoid the noise of the dropping cover.

The entire device proved to be noiseless in operation and in other respects very satisfactory to the experimenter during months of continuous use. With practice the experimenter was able by its means to stop the pendulum at the end of its swing so that it started properly in response to the mechanism of the metronome when the operating lever (*a*) was released.

CHRISTIAN A. RUCKMICH.

Rhythm Hammer

(Fig. 4)

This piece is adapted to drill and demonstrational purposes. It is made up of a steel hammer and anvil, a set of adjustable cams for producing various rhythmic patterns, and a friction speed-gear. The frame is 13½ in. x 19 in. x 7½ in. It has cast-iron sides and steel cross-bars, and it is securely set upon a heavy 3-ply oaken base. A longitudinal shaft, fitted to the centre of the friction-wheel, accommodates as many as nine cams. The cams are slipped into the key-way of the shaft by removing two knurled set-screws which hold the end cross-bar (*a*). Any one of them may be instantly adjusted in the plane of the hammer and thus set into action. The height of fall of the hammer is provided for by two or more radial drops cut in the cam; *e.g.*, a simple 2-rhythm is produced by one high and one low drop set at opposite ends of a diameter, a simple 3-rhythm by one high and two low drops spaced at 120°. Since the hammer may be released (by withdrawing a bit of felt from the anvil-head) upon any beat of the rhythmic unit, two cams suffice for the five primary rhythms. The other cams are reserved for special stimulus-patterns. The apparatus provides, moreover, for a universal cam fitted with slotted eccentric arcs for the production of small temporal and intensive variations. (This cam is not figured.) An adjustable coiled spring (*b*), which fastens the hammer-rod to its forked steel support, determines the general intensity of the pattern. Since the anvil (*c*) and the hammer-support (*d*) are alike capable of

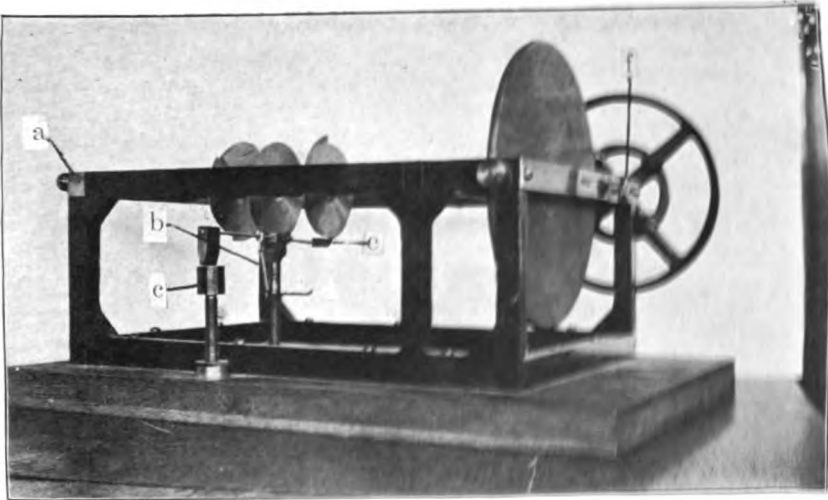


FIG. 4 Rhythm Hammer

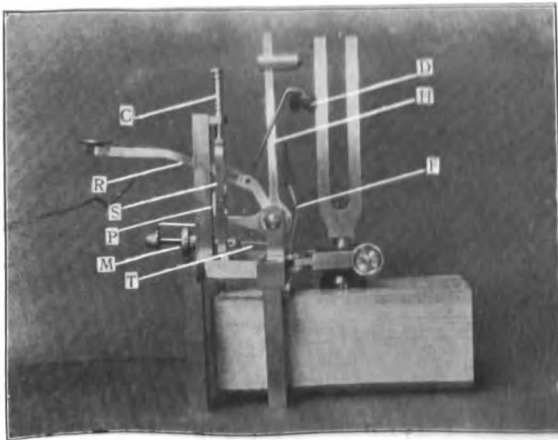


FIG. 5.—Automatic Tuning-Fork Hammer.

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vertical adjustment, cams of various diameters may be used. The tail-piece (*e*) of the hammer-rod is made of fibre to eliminate the noise of contact with the brass cams. The friction-gear and the double pulley-wheel together allow for a variation in speed within the limits 1 to 8. The setting of the drive-wheel against the friction-plate is indicated by a scale-bar (*f*) at the right of the instrument. The piece may be actuated either by a small motor or by a gravity-gear. It is suitable for large or small lecture-room or for the laboratory.

MADISON BENTLEY.

Automatic Tuning-Fork Hammer

(Fig. 5)

As first designed, this instrument was intended to serve as a single unit in a series of eight forks for demonstrational use. It has, however, been found to be very useful also in experimental work. It combines the following features.

(1) The fork is struck rapidly and precisely by a single movement of the hand. It is thus possible to control with accuracy the time of striking. Two or more forks may be so struck together or in succession as to give an interval or a simple melody. A single fork may be repeatedly sounded at very short intervals,—an advantage not shared by those mechanical strikers in which the hammer has to be set by hand before it can be released for the blow.

The mechanism includes a hammer-piece (*H*) and a key-rod (*R*) separate, but pivoted about the same axis, the latter being forked about the former. The key-rod passes through a slot in the slide (*S*) which is free to move vertically in ways fastened to a vertical post. The slide carries a small roller, which works in a slot cut in the key-rod, so that, when the key-rod is depressed, the slide is also depressed. Below the roller the slide carries a pawl (*P*) which engages, when the slide is depressed, with the horizontal arm of the hammer-piece, until, upon being depressed further, the arm is released by clearing the pawl. Thus the hammer, a rubber cushion set in the end of a steel cylinder, is suddenly released, after being brought away from the fork against the action of the tension spring (*T*). After once striking the fork, the hammer is prevented from remaining in contact or from striking again by the flat steel spring (*F*). The slide and the key-rod are elevated after depression by the compression spring (*C*), the pawl being so pivoted as to slip by the arm of the

hammer-piece in the upward stroke. Both pawl and hammer-piece are made of tool steel; the other parts are of brass.

(2) The intensity may be accurately controlled. This is accomplished by a micrometer (M) to which the end of the tension spring is fastened. It is possible to get any intensity from zero up to a maximal strength. For the greater intensities, stronger springs can be used. In this way, the apparatus can be employed in work with the intensive limens.

(3) The fork is automatically damped by the felt damper (D) which is brought into contact with it when the key is released. As long as the key is depressed, however, the fork sounds. This arrangement is useful when different forks are to be struck in rapid succession without fusing, or when a melody is to be given. If desired, the damper can be readily removed, or can be made only partially effective by loosening the compression spring (C).

(4) The hammer can be quickly applied to almost any fork by fastening the wooden base on the resonance box, in which the fork fits, into the felt-covered clamp on the hammer-frame. The position of the hammer on its stem can be varied to the best striking position by means of a set-screw, and the distance of the hammer from the fork can be altered by loosening or tightening the tension spring (T).

(5) The device is supported upon two horizontal rods, which can be made of proper length to bear any number of units desired. It was in such a form that it was planned to build the eight units into a tuning-fork piano.

A single unit can be constructed of brass and steel with sufficient precision to insure accuracy in experimental work for about twenty-five dollars.

EDWIN G. BORING.

THE HISTORY AND STATUS OF PSYCHOLOGY IN THE UNITED STATES

By CHRISTIAN A. RUCKMICH, Cornell University

Since the birth of psychology in America, two attempts have been made to outline the period of its development and to take census at the particular stage of growth reached at the time. In 1891 W. O. Krohn¹ published an account of the work done at seventeen American colleges and universities, a description of the laboratories and the apparatus in use, a note on the development of the departments, and, in some cases, an evaluation of the equipment, including books, instruments, and scholarship and fellowship funds. A few sentences from his introductory paragraph illustrate the condition of psychology at that time. Speaking of the Leipzig laboratory, founded in 1879, he says:

The value of their new experimental method so impressed these students that it was soon carried into effect in other institutions, and happily this new movement early found its way to America. To President G. Stanley Hall and Dr. J. McK. Cattell, Wundt's first American students, belongs the credit of introducing the experimental methods of treating psychology into the American college; the first laboratory being that of Johns Hopkins University at Baltimore, in which laboratory so many of the teachers of experimental and comparative psychology in the various colleges of the United States received their training. From this one comparatively small laboratory at Johns Hopkins the number has rapidly increased to fifteen now in actual use while no less than ten other institutions have taken steps to secure laboratory facilities within a year.

A few years after this account was written, E. B. Delabarre² published statistics with reference to the status of psychology in twenty-seven colleges and universities in America. In addition to historical data concerning the foundation of the laboratory, number of professors and students, and general laboratory equipment, he tabulated the evaluation

¹ W. O. Krohn: Facilities in Experimental Psychology in the colleges of the U. S., *Report of U. S. Commissioner of Education*, 1890-1891, 1139-1151.

² E. B. Delabarre: Les laboratoires de psychologie en Amérique, *L'Année psychologique*, I, 1894, 209-255.

of apparatus, amount of scholarship funds available, number and kind of courses offered, and type of research work pursued. Of the twenty-seven laboratories thus described, eight or nine were devoted exclusively to instruction and demonstration, five to eight were engaged in special research, and about ten were used for both instruction and research. In conclusion he says:

Ce compte rendu correspond à l'état de la psychologie en Amérique vers la fin de 1894. Mais l'intérêt de notre pays pour les études psychologiques est si développé et si profond que le compte rendu de l'heure présente ne sera plus vrai demain. Le nombre des laboratoires continue à augmenter rapidement. . . . Les laboratoires existant augmentent rapidement leurs ressources, et quelques-uns qui n'ont encore qu'une importance secondaire peuvent d'un moment à l'autre recevoir de nouveaux crédits et passer au premier rang. Notre description s'applique par conséquent à un système qui est en voie d'évolution progressive, et qu'on doit juger surtout à ce point de vue.

The progress which Delabarre described in this article has continued almost steadily until the present time, when any large university in the country would consider its plant insufficient in equipment without a psychological laboratory of some sort. There is, however, to the best of the author's knowledge, no statistical inquiry of an adequate kind available, by means of which those interested in the matter can reckon up, as it were, the assets and liabilities in the account to date of our still youthful discipline. It would, in short, be a convenience to those who are watching the progress of the science, to have a brief, yet adequate, description of its attainments after over twenty-five years of growth.

In March, 1911, Titchener sent out a questionnaire for the purpose of obtaining material for an article on the historical development and present status of psychology in the larger colleges and universities of the country. Thirty-nine replies were received. When an attempt to systematise the results was made, it was soon discovered that in consideration of the promise of, and frequently because of the request for, privacy the significant facts concerning present conditions could not be published. These facts related, for the most part, to the status of psychology in regard to other departments; in particular, the relation of psychology to philosophy was subject to frequent criticism. It happened that at about the same time the writer was independently engaged in gathering material from the catalogues of a large number of academic institutions in the attempt to correlate the results for publication.

Opportunely, at the suggestion of Titchener,³ we combined forces and material under a single heading. This work furnished the substance of a previous paper⁴ which, enlarged and elaborated by means of a statistical inquiry conducted by the writer, gave rise, in turn, to the present article.

The questionnaire sought answers to the following:

- (1) When was the psychological laboratory established?
- (2) Who was placed in charge? With what academic title?
- (3) Was the introductory course in psychology (general psychology, elementary psychology) assigned, at the above date, to the experimental psychologist? If not, what department had charge of it?
- (4) Was this course independent, or was it offered in connection with (or in dependence upon) other specified courses?
- (5) What, in these two respects, is the present status of the introductory course?
- (6) With the establishment of the laboratory, was the department of psychology recognised as independent, or was it subordinated to some other department or division? In the latter event, what was its precise relation to the superior department?
- (7) What, in this respect, is the present status of the department?
- (The replies to the two remaining questions were regarded as confidential.)
- (8) Are there any important events in the history of the department (dismissals, readjustments, etc.) that illustrate or supplement your replies to the preceding questions?
- (9) What is your judgment of the present status of the department of psychology in your University?

The answers to these questions are condensed into the accompanying tabular arrangement. With that abbreviation goes some necessary injustice, because parenthetical qualifications and modifications are omitted in the last four columns. Official departmental relations are variously interpreted because of local considerations; where departments are technically separated and independent, the combination of courses in a group-system with those of other departments tends to bind the departments together in such manner that the link is often stronger than in cases of complete dependence. The writer was obliged, therefore, in a few instances, to make very 'close' decisions. On the whole, however, no great wrong was done. The essential facts of the table can be approximately summarised into the following:

Laboratories first began to appear in definite form late in the 'eighties.' Up to and including 1890, 8 such laboratories had been started, and 5 of these were at western state insti-

³ For the material gathered from the questionnaire and for timely suggestions, I wish to express my indebtedness to Professor Titchener.

⁴ Read before the meeting of the Association of Experimental Psychologists at Clark University, April 16, 1912.

tutions. For three years thereafter three laboratories were founded per year. Then the pace kept on by ones and twos, with threes in 1900 and 1901, until a halt was called in 1904. A few more have come since then. The two most prolific periods seem to be about 1890 and 1893. It is interesting to note that with the appointment of Scripture at Yale in 1893 used as a node to divide the series, the percentage of total appointments assigned to men with academic rank in psychology (as indicated by italics) is approximately the same for each period, although the division favors the first period on account of its temporal brevity. Altogether 22 out of 36 (61 *per cent.*) held such title at the time of appointment. More recently, also, the introductory courses have gone to psychologists and have received greater independent recognition, especially since 1898. This result is not wholly unexpected, because seven of the courses in introductory psychology, though not originally independent, have now become self-sustaining. Eight courses, however, are still, in one way or another, dependent on some other department, usually on that of philosophy. Eight departments of psychology have been created out of former alliances with philosophy, but eighteen institutions still have affiliations of psychology to philosophy.

Reading horizontally across the table, we find the following conditions to hold: 7 out of the 39 institutions, viz., Clark, Illinois, Missouri, Cincinnati, Tennessee, Tufts, and Dartmouth, have had psychologists in charge and have had their department and courses independent from the beginning of things; 9 more, viz., Harvard, Wisconsin, Nebraska, Brown, Kansas, Texas, Wyoming, Washington, and Vassar, have always had their introductory courses independent, but have departmental affiliations to some other discipline, usually philosophy; to this list 7 institutions, viz., Wellesley, Chicago, California, Northwestern, Mt. Holyoke, Bowdoin, and Montana, may be added as institutions which hold to these conditions (*i. e.*, introductory courses were always independent, and departments have been dependent) with the exception that their departments are now independent; 2 institutions, viz., Iowa and Columbia, have had their introductory courses dependent, but now have those courses, and always have had their departments, independent; 2 more, viz., Cornell and Ohio State, have had both department and introductory courses dependent, but have relieved themselves of that condition now. Many more comparisons could be drawn.

Statements made in answer to the last two questions were promised confidential treatment, and will therefore be pre-

sented without reference to source. Local identification and definite orientation would, indeed, contribute to the adequate interpretation and significance of the remarks made, but the limitation imposed is, of course, a necessary one. For that reason, pertinent generalisations must be our only resource.

The replies seem to group themselves roughly into two large categories: (1) those coming from departments of psychology that are independent, and (2) those coming from departments affiliated to other departments, or combined with another discipline into a single larger department. The second group subdivides into three sections: (a) conditions are reported as favorable and satisfactory, (b) conditions are reported as unfavorable, owing to demands made upon psychology by education, and (c) conditions are reported as unfavorable because of affiliations to philosophy.

In the institutions where psychology is absolutely independent, there seems to be, in general, no cause for complaint. Full recognition has not only been gained, but also, in almost all cases, rapid progress is being made in the way of increasing registration of students, academic work accomplished, and the establishment of prestige in the institution. If a general impression is allowed, it would not be far amiss to state that the replies from such departments are enthusiastic and hopeful. In one or two instances, especially from state-controlled institutions of the west, a note of regret was heard in regard to the demands that the department of education, usually a state board, was making at the hands of the psychologist. In such cases, a direct attack, in contrast to insidious attacks made elsewhere when numerous applied problems are brought to the theoretical psychologist for solution, is hardly unexpected, and gives a good example of the practical tendencies of many of our state universities. The pressure, however, is not very frequent or very heavy, and can be met in time by the appointment of an educational psychologist whose point of view is that of application. Wherever psychology is affiliated to other departments, in most cases to philosophy, more infrequently to education, we have a twofold possibility of conditions: either (1) the situation is agreeable and satisfactory, or (2) complaint is made. In about one half of the institutions where psychology is affiliated to philosophy, conditions are reported as favorable to the younger discipline. It must be noted that there are many degrees of affiliation, and that most of the favorable reports come from institutions where the affiliation is partial and for the most part theoretical. In some universities, the philosopher was on the ground first,

and is technically the head of the combined department of philosophy and psychology, but he receives a salary equal to that of the psychologist, sometimes has less 'academic prominence,' and frequently allows the psychologist to go to the president, or board of trustees, directly, for administrative consultation. In such instances there seems to be good personal relationship and friendship in the combined department. In the remaining situations, where this favorable condition does not exist, the reasons for complaint are various. The most frequent complaint is to the effect that wherever students in psychology are also required to elect philosophy they fall into a 'philosophising tendency' which works havoc with the empirical approach attempted by modern psychology. Here seems to lie the main point at issue. In spite of repeated efforts to the contrary,⁵ it must be conceded by the philosophers that the method of approach of their discipline and sub-disciplines is not of the same empirical nature as is that of the psychological laboratory. Furthermore, in most instances of satisfactory condition between psychology and philosophy, it is found that the type of psychology taught, as outlined in the catalogues of the institutions concerned, is the philosophical, non-empirical, generalising variety current before 1880. It is not the purpose of this paper to discuss at length the question of the nature of experimental psychology as compared with that of the philosophical disciplines, but to record the opinions of those who answered the questionnaire. A number of these replies indicate, in no uncertain terms, that affiliation to philosophy is unfortunate;⁶ that, if affiliation becomes necessary on the score of administrative economy, occupancy of the same building, and elective group systems, in at least three instances, academic relationship with the biological sciences is preferred; and that the 'scientific approach' of experimental psychology is responsible for the steady progress of the discipline. There are other handicaps imposed upon psychology in institutions where the science is not independent. Sometimes philosophical courses are made compulsory, while psychological courses are entirely elective; often psychological courses can be elected only in conjunction with philosophical courses; frequently an old-fashioned pedagogical department demands a primitive type of educational

⁵ For a detailed discussion of the subject see E. Albee: Descriptive and Normative Sciences, *Philosophical Review*, xvi, 1907, 40; J. Boodin: *Truth and Reality*, 1911, 288; G. Sabine: Descriptive and Normative Sciences, *Philosophical Review*, xxi, 1912, 433.

⁶ As early as 1891, H. Münsterberg advised a separation of psychology and philosophy: *Aufgabe und Methoden der Psychologie*, 1891, 270.

psychology. In two institutions the department of psychology seems to be doomed to elimination for financial and personal reasons. In general, however, the progress of psychology is assured. In several institutions an independent department of psychology is about to be, or has been at this time, about a year after the expectation was expressed, established. The total impression gotten from a perusal of the comments contained in the replies is one of patient endurance not uncolored with the hope for better things to come.

The second part of the investigation was made with a view to compare, if possible, the standing of psychology as an academic discipline with that of several other disciplines. In the search for a discipline of approximately the same age as psychology, we discovered that political economy, established as an academic discipline about 1885, at the time of the meeting of the American Economic Association, would meet the requirements. Education and physiology were next suggested, because of their intimate historical connection with psychology, contributing, respectively, educational and physiological psychology. Physics was next considered because of its well-established recognition as an empirical science, and because of its traditional relations with the mental sciences in the field of knowledge,⁷ and then philosophy because it, without doubt, is the parent of psychology in this country. As the work of gathering material from the 1910-11 catalogues of the 39 institutions was proceeding, it became evident that physiology did not lend itself to treatment, because its academic demarcation from such subjects as anatomy, medicine, morphology, histology, and biology was far from rigid. Complications also arose in connection with the medical schools of universities. Zoölogy was therefore substituted for physiology. The material gathered consisted of the number of professors, assistant or associate professors, instructors, and assistants, together with the number of subject hours per week per year for each of the six disciplines named, in each of the 39 institutions. Whenever an officer is connected with more than one department, an equal portion of his time, and, consequently, also his statistical value, is assigned to each department; *e. g.*, a professor of philosophy and psychology obtains one-half credit under philosophy and one-half under psychology. The distribution of officers among the disciplines is, then, as follows: physics, 265 (66 professors, 62

⁷This may be expressed by the Cartesian formula: *World = Mind + Matter*, or by the Herbartian equation: *World of knowledge = Mental Sciences + Natural Sciences*.

assistant professors, 64 instructors, 73 assistants); zoölogy, 175.5 (51 professors, 45.5 assistant professors, 39 instructors, 40 assistants); political economy, 175 (62.5 professors, 46 assistant professors, 41 instructors, 25.5 assistants); philosophy, 123.5 (73 professors, 20.5 assistant professors, 15 instructors, 15 assistants); education, 102 (50 professors, 27.5 assistant professors, 13.5 instructors, 11 assistants); and psychology, 88.5 (32.5 professors, 19 assistant professors, 19 instructors, 18 assistants). The total number of academic hours ('university hours' per year) offered by each discipline is: political economy 3009, physics 2740, zoölogy 1944, philosophy 1671, education 1392, psychology 1190.

It was then considered desirable to correlate the number of university officers with the number of hours offered in each of the six disciplines in every one of the 39 institutions. In order to do this, and in the absence of any other recognised method of procedure, the academic rank of instruction was weighted by a factor proportionate to the relative average salary for that rank in America.* These factors were 2.5 for professorships, 1.75 for assistant professorships, 1. for instructorships, and .5 for assistantships; i. e., the total number of hours offered at a given institution in a given subject was multiplied by 2.5 for every professor in that subject, by 1.75 for every assistant professor, and so on. The product, because the instructor factor is unity, is termed the 'instructor hour.' Academic titles of officers determine the tabulation under the department: the fact that, e. g., an instructor in psychology gives courses in education does not classify him under 'education,' but the fact that he has academic rank and title 'in psychology' gives him the qualification of classification under 'psychology.' Associate professors, or associates, or preceptors (at Princeton) are classified under 'assistant professor.' Hour units are for one academic year exclusive of summer sessions, and courses in the summer session are not counted. Additional sections in a single course are counted as additional semesters with the corresponding number of hours. Educational psychology is credited under psychology. When courses in education are given in a separate school of education, only those courses are counted which bear on the theory, philosophy, and principles of education. Practical and technical courses are

* The Carnegie Foundation for the Advancement of Teaching: *The Financial Status of the Professor in America and in Germany*, Bulletin 2, May, 1908, 21, 30, 31, is responsible for the following average salaries: professor \$2500, associate professor \$1900, assistant professor \$1600 (average of the two \$1750), instructor \$1000, and assistant \$500.

TABLE II. RELATIVE RANK IN TERMS OF
'INSTRUCTOR-HOURS'

	Psy- chology	Educa- tion	Zoöl- ogy	Pol. Econ.	Phys- ics	Philoso- phy
Columbia†.....	1730	1370	1655	1060	4180	3561
Chicago.....	420	885	756	1127	924	500
Minnesota.....	131	525	1180	602	602	134
Cornell†.....	232	157	214	1650	4560	1020
Wisconsin†.....	150	530	572	3220	2140	475
Michigan.....	105	376	701	859	2640	728
Illinois†.....	258	502	1230	1658	1463	205
Northwestern.....	119	140	310	427	162	119
Nebraska†.....	28	510	860	615	1065	585
Harvard†.....	279	270	920	1425	1362	1362
California†.....	158	501	731	420	1230	644
Ohio State.....	280	392	1104	926	1662	420
Yale.....	375	48	1120	1542	2920	1090
Missouri.....	442	98	252	374	493	185
Texas.....	20	1200	292	212	605	170
Kansas†.....	132	803	899	220	693	246
Indiana.....	117	608	378	351	434	188
Washington†.....	59	497	542	875	426	138
Iowa.....	130	545	1118	1035	882	155
Tennessee.....	20	57	54	15	20	22
Princeton.....	72	—	30	667	1733	568
Smith†.....	108	69	210	72	256	217
Cincinnati†.....	81	98	120	42	575	63
Colorado.....	94	262	75	83	184	93
Dartmouth†.....	37	9	114	360	287	45
Wellesley†.....	167	45	314	280	203	127
Tufts.....	6	3	190	126	115	210
Vassar†.....	48	3	45	112	298	90
Brown.....	80	132	96	213	360	384
J. Hopkins.....	111	5	298	136	781	159
Mt. Holyoke†.....	96	45	150	21	290	77
Vermont†.....	8	60	46	166	98	25
Amherst†.....	13	6	60	102	126	32
Bryn Mawr.....	90	12	81	136	170	273
Bowdoin†.....	45	—	58	26	40	30
Wesleyan†.....	38	—	35	27	253	50
Wyoming.....	26	75	22	101	150	20
Montana.....	41	37	61	24	75	17
Clark Univ.....	126	25	50	14	120	8

† Marks institutions represented in the last three tables.

excluded. Political economy or economics is differentiated from political science and sociology. The latter courses are excluded. The results of this correlation appear in Table II. In this and the following tables, institutions are placed in the

order* of total registration of students in the institution, highest registration leading. Of the 39 institutions tabulated, 19 appear in the two following tables (indicated by obelisk). Since a cross comparison will later be made between the three tables, it was deemed necessary to calculate averages for only these 19 institutions. The average number of 'instructor hours,' therefore, is: physics 1029, political economy 650, philosophy 473, zoölogy 451, education 288, and psychology 193. Expressed in *per cent.*, the disciplines rank, according to this comparison: physics .334, political economy .211, philosophy .152, zoölogy .146, education .094, and psychology .063.

By means of correspondence it was possible to procure the number of student registrations for each of the disciplines in a large number of these 39 institutions. It was not possible to establish a uniform method of counting these registrations, because some of the figures given represent registrations, others eliminate double or triple registrations, *i. e.*, cases where the same students are registered in more than one course at a time, and thus represent separate students. No great error, however, results. Most of the figures given are actual registrations and not estimates. Registrations for both semesters are added, giving registration for the year, 1910-11. To obtain averages for the six disciplines compared in the 19 institutions, it was necessary, in a few instances, to divide the registration given for combined departments, arbitrarily, into equal shares under the heading of the disciplines that were thus combined. The average registrations thus derived are: political economy 636, physics 568, philosophy 298, education 292, psychology 244, zoölogy 187. Arranged in *per cent.* of distribution, these figures give: political economy .286, physics .255, philosophy .133, education .132, psychology .110, and zoölogy .084.

One of the most adequate bases of statistical comparison seems to be the financial; but it is at once the most difficult of treatment. Although treasurers' accounts are not as unintelligible and as unsystematic as they are sometimes said to be,¹⁰ enough deviation from a standard method exists to make occasional trouble. Luckily most of these deviations did not materially affect this investigation. Most of the confusion arose because of the way in which expenditures for several

* *The World Almanac*, 1912, is authority for this order. No more reliable source of information was at hand which gave statistics for all the institutions considered. The order is based on registration figures for 1910-11, including summer session.

¹⁰ C. F. Birdseye, *The Reorganisation of our Colleges*, 1909, 340.

TABLE III. REGISTRATION

	I Psy- chology	II Educa- tion	III Zoöl- ogy	IV Pol. Econ.	V Phys- ics	VI Philoso- phy
Columbia† . . .	210	1725	102	ES 445	830	466
Minnesota . . .	736	626	1047	1286	399	259
Cornell†	318	243	118	EL 2214	4200	543
Wisconsin† . . .	347	365	68	1290	553	168
Illinois†	412	280	382	418	1050	304
Nebraska† . . .	*312	320	173	303	248	I
Harvard†	303	299	244	2332	330	828
California† . . .	VI	836	521	485	1205	*1461
Kansas†	376	160	257	533	126	378
Washington† . .	VI	216	178	439	280	*248
Smith†	VI	VI	195	337	160	*597
Cincinnati† . .	164	471	111	354	238	210
Dartmouth† . .	54	14	121	918	763	76
Wellesley† . . .	303	134	189	441	123	259
Tufts	43	9	1	55	78	84
Vassar†	382	32	36	567	219	542
Mt. Holyoke† .	190	190	334	122	162	85
Vermont†	21	40	30	20	42	20
Amherst†	164	18	330	260	122	270
Bryn Mawr . . .	*135	16	BEem 79	122	61	I
Bowdoin†	95	—	124	350	59	129
Wesleyan† . . .	97	—	49	257	81	182

BEem Biology and embryology combined with zoölogy.

EL Economics and sociology combined with political economy.

ES Economics and political science combined with political economy.

* Indicates that number so marked is shared by some other department.

Roman numerals indicate the department with which the registration is shared.

† Marks institutions represented in the last three tables.

departments or disciplines were lumped into a single budget. Difficulty also arose from the fact that in some cases there were special reasons for an abnormal—either subnormal or supernormal—expenditure, such as reduced salaries paid to substitutes during a regular officer's leave of absence, increased appropriation because of a method of annual rotation of appropriation among the departments, decreased appropriation because of a previous year's unusually large expenditure, or because of a special reorganisation of a department. The amounts given under 'other appropriations' are not uniformly classifiable under any definite heading. As a rule, however, administrative and building expenses are excluded. We have, then, presented in Table IV a list of expenditures

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for the six disciplines in a number of institutions for the academic year 1910-11.¹¹ Whenever an expenditure covers more than the discipline in whose column it is found, that fact is recorded either by a symbolic letter prefixed to the amount, which letter is interpreted in the legend, or by an asterisk, in which case the department which shares the amount is indicated by a Roman numeral referring back to the column where the amount is found. In the comparison of appropriations given below,¹² an arbitrary division similar to that made in Table III has been resorted to in cases where a number of departments share a given amount. It is assumed, for purposes of correlation, that the amount is equally shared. All of the deviations described are so comparatively few in number, and generally affect the 19 institutions compared to so small an extent, that they may be virtually neglected. The average appropriations for the six disciplines in the 19 institutions considered are, then, as follows: physics \$15545, education \$13350, political economy \$12160, zoölogy \$11090, philosophy \$6545, and psychology \$5285. Converted into *per cent.* of money distribution, these amounts give the following results: physics .240, education .210, political economy .191, zoölogy .175, philosophy .102, and psychology .082. Combining Tables III and IV, we get the following *per capita* expenditure: zoölogy \$59.32, education \$45.73, physics \$27.58, philosophy \$21.97, psychology \$21.67, and political economy \$19.12.

An attempt was made to summarise the results of these three tables by means of a correlated average rank for each of the six disciplines. The application of Spearman's 'foot-rule' indicated, however, that the correlation was neither constant nor adequately representative. The best we can do, then, is briefly to outline the facts brought out in the tables. On the whole, psychology foots the lists more often than any other discipline. In this respect it is the most consistent of them all. Political economy, of equal age with psychology, heads the list with the greatest number of university hours, while psychology foots the list with the lowest; in the matter of appropriations, education, the youngest of all the disciplines

¹¹ The single exception is the University of Cincinnati whose fiscal year ends Dec. 31. The year given in this case ends Dec. 31, 1911.

¹² Grateful acknowledgment must be made of the courtesy shown by correspondents in furnishing the desired information. All of the material used in this article was obtained by the author through replies made to questionnaires. Realising the usual annoyance arising from this form of request, the author wishes to give full recognition to the kindness shown by these correspondents.

represented, and political economy, occupy second and third places respectively, while psychology occupies the last; in the number of 'instructor hours,' political economy is second in rank, psychology is lowest; in the number of officers of instruction, political economy is third on the list, psychology is last; in the matter of student registration, political economy heads the list, psychology occupies the next to the last place; education leads with the largest *per capita* expenditure, psychology is next to the end.

After this statistical presentation, a few remarks concerning the condition of psychology as an academic discipline may not be out of place. We find that psychology, after over 25 years of growth, does not stand very high on the honor roll among other academic subjects. Other disciplines, of equal age or younger, have, in several instances, decidedly surpassed it in rank. Various explanations may suggest themselves, but the following seem to the writer to be the most adequate:

(1) Ranking in terms of financial support given, number of student registrations, and the like, may not sufficiently interpret academic prestige, or account for the work that a discipline has accomplished among other disciplines. Certainly education has emphatically, physiology and the social sciences have to some extent, benefited by the application of results obtained in the psychological laboratory. How much, on the other hand, psychology is indebted to physics for its contributions to psychophysical problems, to physiology and anatomy for their functional and structural points of view and facts, to anthropology and the social sciences for their contributions to genetic and group psychology, and to zoölogy for suggestions in comparative work, is, likewise, a difficult matter to compute.

(2) Pure sciences, without definite aim at application, are usually slow of academic growth at the beginning of their establishment. The smaller the possibility of application, the slower is the growth: witness such sciences as astronomy, botany, zoölogy, and geology,—astronomy probably footing the list, if a general impression be allowed, with a correspondingly small possibility of application.

(3) The hardships of progress are most decidedly emphasised when the discipline in question is attempting to gain credit at once in the world at large and in the university, *i. e.*, when it lacks a long historical development antedating

academic recognition. If its progress is well established before the university appears on the scene, attainment of academic approval is easy and rapid. Experimental psychology originated in 1879, and during the next few years it was already a candidate for admission to the American academic curriculum. Its academic growth is, therefore, almost coëval with its progress in the world at large.

(4) The establishment of laboratories in connection with an empirical psychology is necessarily slow and laborious because of the initial expense involved, and for the reason that space has to be procured and a staff of assistants must be chosen. This may explain, in a measure, the fact that the *per capita* expenditure for psychology, a laboratory science, is about equal to that of philosophy, not a laboratory science. Adequate laboratories have not been everywhere provided.

(5) The introspective method, peculiar to the psychologist, may offer a hindrance to the ready acceptance of the discipline because of the false assumption that it requires either an abnormal gift of some sort or years of toilsome training. The very fact that the method is itself variously interpreted, and sometimes poorly understood even by psychologists, suggests that there is difficulty.

Some of these explanations may be found to apply to other disciplines as well; but, perhaps, psychology suffers to the greatest degree because in her case all of the factors mentioned operate together.

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THE EFFECT OF ILLUMINATION ON PERIPHERAL VISION ¹

By LUCY MAY DAY

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¹ From the Psychological Laboratory of Cornell University.

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INTRODUCTION

I. Problem.—In a cluster of recent studies¹ in peripheral vision, we find the statement that peripheral stimuli, which are themselves subliminal as regards color, may under favorable conditions induce colored after-images. These anomalous after-images are said to appear most often under conditions of intense illumination, with the stimuli shown upon a white background. On account of the theoretical importance of this statement, it was thought worth while to repeat the experiments. With this end in view, certain experiments were performed in the Cornell Laboratory by Titchener and Pyle.²

¹ H. B. Thompson and K. Gordon: A Study of After-Images on the Peripheral Retina, *Psychol. Rev.*, XIV, 1907, 122-167. G. M. Fernald, The Effect of the Brightness of Background on Color in Peripheral Vision, *Psychol. Rev.*, XII, 1905, 386-425; *ibid.*, XIV, 1908, 25-43; also *Psychol. Monographs*, X, no. 3, 1909.

² E. B. Titchener and W. H. Pyle, On the After-Images of Subliminally Colored Stim., *Proc. Amer. Philos. Soc.*, XLVII, No. 189, 1908, p. 377.

The outcome was negative. It seemed, however, that the "most favorable conditions" required had not been secured; and further tests were therefore necessary.

The present study was undertaken largely for the purpose of furnishing such supplementary tests. It was thought, moreover, that further work might throw light on certain irregularities in Fernald's general results. We undertook, therefore, to repeat Fernald's experiments, with additional variations, under exactly duplicate conditions.

After our experiments had been completed and put in what then seemed final form, a paper appeared^{*} in which Fernald's theses were attacked from a new direction. Rand and Ferree now declared that instead of selecting the most favorable conditions for her phenomena—colored after-images from colored stimuli sensed as colorless—Fernald had chosen the very worst. They were unable to confirm the results that she obtained in the Bryn Mawr and Chicago laboratories; *i. e.*, they failed (as a rule) to get the anomalous colored after-images, when a white background was used. On the other hand, they were able, if they used a black background, pre-fixation ground, and projection ground, to secure these anomalous after-images practically in every trial.

These new results—obtained in both direct and indirect vision—were startlingly at variance with what Fernald had found in her work with the black background; they were, moreover, the reverse of what our experiments had yielded. Indeed, they so flatly contradicted our findings that it seemed prudent to put them again to the test before advancing our own observations. It was evident that the method of Ferree and Rand differed in some details from ours—exactly in what ways, we could not fully make out from the (thus far) incomplete account of their method. We were told, however, that for the best results a black background, pre-fixation ground, and projection ground should be used; and that the white after-image of the black pre-fixation ground (fixated for 5 or 10 sec.) should be projected on the stimulus, which should itself be fixated for only 2-3 seconds. With these meagre directions to guide us, we repeated a large part of the work with the black background. The variations in method introduced, and the results obtained, will be given under the proper headings in the body of this paper.

^{*}C. E. Ferree and G. Rand, Colored After-Images and Contrast Sensations from Stimuli in which no Color is Sensed, *Psychol. Rev.*, XIX, 1912, 195-239.

II. Apparatus.—The apparatus employed was, so far as seemed advisable, identical with that of Fernald. It consisted of a vertical two-sided campimeter similar to that pictured and described by her.⁴ The stimulus frame was essentially the same as hers; but the screen which covered the stimuli, instead of being drawn to one side, was raised and lowered by a device which perhaps permitted greater rapidity of movement. When needed, an electric motor was suspended in the same position as the stimulus frame. The backgrounds used were platinum medium grey, white and black, and Hering velvet black. The stimuli were ten Hering colors: red, orange, orange-yellow, yellow, yellow-green, green, blue-green, blue, violet and purple; also Hering velvet black, and platinum grey.

Instead of a simple biting-board with triangular support, the Hering head-rest (with individual biting-boards) was used to

DIAGRAM OF ROTATION DEVICE ON BASE OF HERING HEAD-REST



a = depression in lower surface of base of head-rest.

b = movable brass plate, carrying pivot pin, *c*.

d, d = set screws in slots, *e, e*, for holding *b* in position.

keep the head in position. A special rotation-device⁵ was arranged on the lower surface of the base, directly under *O*'s right eye (see diagram). The pivot pin *c* fitted into a hole in the table, which was in the plane of a perpendicular from the opening in the campimeter screen. For a given *O*, the plate *b* was so set that the distance from *c* to the center of the head-rest was exactly one-half the distance between the centers of *O*'s pupils. The modified head-rest thus provided for accurate determination of the position of *O*'s right eye (we used, as did Fernald, only the right eye, and stimulated only the left horizontal meridian of the retina), and in addi-

⁴ *Psychol. Monog.*, X, No. 3, 1909, 16, 17. Details which were not clear to the writer were kindly furnished by Miss Fernald in correspondence.

⁵ For this device we are indebted to Mr. W. S. Foster, assistant in the Graduate Laboratory.

tion for easy rotation to any desired angle. The adjustment once made was, therefore, constant for a given period of experimentation, and could easily be reproduced at subsequent sittings. It provided a further advantage, lacking in Fernald's arrangement, in that, after a single adjustment, *O* could fixate any number of points without turning his eyes.

The apparatus was set up in a large room (with light grey calcimined walls) on the top floor of the laboratory, directly beneath a 6 x 8 ft. skylight. The results reported were obtained (unless otherwise specified) on bright days, at hours when the sunlight shone directly on the skylight. A careful record of the illumination was kept, so as to ensure the most favorable as well as the most constant conditions. Most of the results were obtained in the spring, summer, and fall of 1911 and the spring of 1912. The tests made with the view of investigating the results of Ferree and Rand were carried on during the summer of 1912.

III. Observers.—Eight observers—the most highly trained in the laboratory—served in all or some of the experiments. Of these, Miss Goudge (*G*), Dr. Jacobson (*J*),⁶ and the writer (*D*) were graduate students in psychology of two or more years' standing; Messrs. Boring (*B*) and Foster (*F*) were graduate assistants in the department; Mr. Tappan (*T*), an instructor in civil engineering, was carrying on graduate work in the department; Dr. Geissler (*Ge*) and Mr. Ruckmich (*R*) were instructors in psychology. All the observers possessed normal color vision. *G* gave warning that her experience in the Bryn Mawr laboratory had shown her to be deficient in sensitivity to after-images. *R* stated, at the outset, that he was highly suggestible to color.—In the last series of tests (summer, 1912), *R*, *F*, and Professor Baird of Clark University served as observers.

METHOD

I. General Procedure.—In general the method of procedure was essentially that of Fernald.⁷ *O* was seated in a chair, whose height was adjustable, in front of the Hering head-rest, which was itself placed in front of the campimeter screen (as described above). The rotation-device was adjusted for the distance between his eyes; the Hering head-rest was set for the given observer (the settings were determined once for all, before experimentation was begun); *O*'s biting-board was

⁶ *J* showed extreme liability to eye-strain and was, therefore, soon discarded.

⁷ *Psychol. Monog.*, X, No. 3, 1909, 19, 20.

placed in position. The black velvet eye-shade was adjusted to cover *O*'s left eye. He then verified the accuracy of his position by making sure that a circle on the middle of the stimulus screen did not change its position, with reference to the opening in the campimeter screen, on rotation of the Hering head-rest. Inasmuch as the head-rest could be rotated to any angle, *O* was now prepared to take any fixation, without thereby incurring the slightest amount of eye-strain. There was, of course, no way of avoiding the eye-strain aroused by long-continued fixation; but the device gave us a signal advantage over Fernald's arrangement, which provided for only one position of the biting-board.

There was no further allowance of time for achromatic adaptation. Sometimes, however, *O*'s adaptation was tested by the presentation of grey stimuli. The regular experimental series (presentation of the ten colors and black and grey in haphazard order) then ensued. *O* took the desired fixation, and tapped on the table. *E* gave the signal "ready," and immediately raised the stimulus screen,^a exposing the chosen stimulus. After an exposure of 5 seconds (determined by the stop-watch) *E* gave a signal "now," and, after a moment, lowered the stimulus screen over the stimulus. In case the color seen by *O* disappeared before the five seconds were over, *O* signalled by a tap to *E*, who immediately lowered the screen. *O* held his fixation until all traces of the after-image had disappeared, waiting, as a rule, some time longer for certainty. *O* was now required to report in full on the hue, tint, and chroma of both sensation and after-image. He was shown a duplicate of the small-sized Hering *Farbenkreis* and was asked to place the colors experienced among those of the Hering series; if a color fell between two adjacent colors of the circle, it was so designated, emphasis being given when possible to the predominant component. *O* was also required to note other experiences connected with the color, *i. e.*, number of recurrences and relative duration of after-images, changes in hue in either sensation or after-image, color seen during the fore-period of a given test, eye movement during prescribed fixation, eye-strain, inattention. For a number of experiments *E* carefully watched *O*'s eyes, so as to note the occurrence of perceptible eye movement. *E* kept a record of all such relevant data, as well as of the report proper. In case *O* reported a color during the fore-period, the time-interval was lengthened; otherwise, the next stimulus was presented two minutes (or more) after *O* removed his teeth from the biting-

^a The prefixation period was thus minimal.

board; the interval was recorded by stop-watch, and the exact time was recorded by *E*.

II. Methods.—Two main lines of method (A and B) were laid out. In the first (A), the ten Hering colors and platinum grey and black were presented in haphazard order as stimuli. The backgrounds were platinum medium grey, Hering velvet black, and platinum white.

A 1. The first experiments were performed with the platinum grey as background and projection ground (*i. e.*, screen on which the after-image was projected). This background, it was thought, would be the most favorable for both sensations and after-images, and would therefore serve as a fairly easy introduction to the more difficult work with black and white backgrounds. Sets of results, at fixations from 20 to 90 degrees, were obtained (with some gaps) from five observers. In the first part (*a*) the Hering colors mounted on cards were used as stimuli. At the start they were presented to the observers, at fixations from 55 to 90 degrees (this was our interpretation of Fernald's "more peripheral points"), as long as any color was seen. This time, however, was found to be too long; the observers soon complained of eye-strain. The exposure time for all fixation-points was then arbitrarily fixed at 5 seconds (or less, if the color disappeared within that time). In the second part (*b*) certain Hering colors, mixed with varying amounts of black or white, were presented as stimuli. Some observations were also made (*c*) in which the individual after-images of Hering colors were projected successively on different backgrounds.

A 2. The Hering velvet black was next used as background. (*a*) Full sets of results (20 to 90 degrees fixation) were obtained with six observers for the ten Hering colors. (*b*) Observations were also made by three of these observers, for fixations from 60 to 90 degrees, with the black background and the platinum medium grey as projection ground.

A 3. The platinum white background was reserved until last, in order that the observers might have the advantage of a year's training. This background, it had been asserted, was the most favorable to "colored after-images from unperceived stimuli." To it therefore we devoted the most time, taking, with the white background and projection ground (*a*) some 1,700 observations from five observers (as compared with 650 for platinum grey and 1,100 for Hering black). The majority of the results were obtained at the more peripheral fixation points. Additional sets were taken under special conditions with (*a'*) the attention variously directed (*i. e.*, sometimes on the stimu-

lus, sometimes on the after-image) and with (a'') variations of the time interval between experiments. Results were also obtained (b) from two observers, with the white background and black projection ground. Only a few tests—because the method proved too fatiguing—were taken (c) in which the observer fixated the white ground for some time (5, 10, or 15 seconds) before exposure of the stimulus, thus mixing the dark after-image of white with the stimulus.

In the second part (B) of the problem, the aim was to determine (1) the *Urfarben* and (2) their limits for the different backgrounds. Mixtures of Hering red, blue, green, and yellow, and black and white were the stimuli. Our present procedure differed from that of A, in that we now presented a single stimulus continuously, starting at either 0 or 90 degrees fixation, and taking successive fixations to 90 or 0 degrees respectively. Our method was essentially that of Fernald.⁹

RESULTS

General Interpretation of Tables.—Inasmuch as frequent use will be made of tables it may be well to give here a general interpretation of the symbols used. The colors are always indicated by their corresponding initials (R = red, OR = orange-red, BG = blue-green, BlG = bluish green, etc., of the Hering series). The symbols for two colors connected by a hyphen indicate a color the hue of which lies between the two hues indicated; if the one component is predominant the corresponding symbol is italicised. A line — is used to indicate colorless sensations or after-images. The numerical subscripts under color symbols indicate the number of times of occurrence.

1. Effect of Background on Sensation

A. Changes in Hue

1. With Medium Grey Background

Table I gives a representative account of the course of the sensations from the ten color stimuli. It will be seen that here (as in the case of the other observers): (1) sensations from the red stimulus undergo little change from 20 degrees to 90 degrees of fixation, shifting only slightly toward orange; (2) with the orange we have a decided shift through orange-yellow practically to yellow; (3) orange-yellow becomes yellow at the extreme periphery; (4) yellow soon loses its slightly

⁹ *Psychol. Monog.*, X, No. 3, 60.

greenish cast, but is otherwise constant; (5) yellow-green passes through greenish-yellow to yellow; (6) green shifts quickly toward yellow and is soon colorless; (7) blue-green passes through greenish blue toward blue; (8) blue is fairly constant; (9) violet becomes blue; and (10) purple passes through violet to blue. Thus red, orange, orange-yellow all shift (the amount depends roughly on the proportion of yellow in the stimulus) toward yellow; while blue-green, violet and purple shift toward blue. In both cases the green component

TABLE I

O—B

Grey Background.

Fix'n. °	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
90	—	Y? Y-OY	Y	Y	—	—	—	—	—	—
85	—	Y-OY	OY-O Y	Y	Y-GrY Y	—	—	B	B	B B?
80	O R	Y-OY,	Y	Y	Y-OY	—	B	B	B	—
75	OR-O OR	Y-OY	O-OY OY	Y Y-OY	Y	—	GrB	B	B	—
70	OR	O-OY	Y-OY	Y	Y	—	GrB	B	B	V-P
65	OR	O	Y	Y	Y	—	OY-O	B	B	P
60	OR-R	O-OY	OY	Y	Y	—	GrB-B	B	B-V	P-V
55	O _s	OY	OY-O	Y-OY	Y-GrY	YG	B-GrB	B	B	P
50	OR-R	O	OY-O	Y	Y-GrY	YeG	GrB	B-GrB	B-V	P
45	R	OR-O	O	Y	YG-Y	YeG	GrB	B	V-B	V-P
40	OR-R	O	OY-Y	Y	YG-GrY	YeG-YG	GrB-BG	B	V-P	P
35	R	O	Y-GrY	Y	GrY-Y	YeG	GrB	B _s	B	P
30	R-PR	O	OY-Y	Y	GrY-Y	G	BIG	B	V-P	P
25	R-PR	O	OY	Y	YG-GrY	YeG	BIG	B	V	P
20	OR	O	OY	Y-OY	YG-GrY	BIG	BG	B	V-P	P

needs to disappear first, before the red, & that this we may personally attribute to the proper saturation of the other.

The Hering Black is background.

Table II is typical of the course of the sensations from the test colors, with the black background. It also shows a gradual and pronounced shift toward yellow, becoming nearly orange-

TABLE II

Black Background

Time	Sensations									
	R	G	B	Y	YG	G	BG	B	V	P
10	O	O	Y-O	Y	Y	—	GrB	GrB	GrB	GrB
15	O	O	Y-O	Y	Y	—	GrB	GrB	GrB	GrB
20	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
25	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
30	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
35	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
40	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
45	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
50	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
55	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
60	O	O	Y-O	Y	Y	—	GrB	B	B	GrB
65	O-OR	O-OR	OY-O	OY-O	O-OY	OY-O	BG	B	B-V	B+P
	O	OY-O	Y-OY	OY	Y	—	GrB	GrB	GrB-V	P-PR
70	O-OR	OY-O	OY-O	Y	Y-OY	Y	BG-GrB	B	B	B
	O	OY	Y	Y	Y	—	GrB	GrB	V-GrB	P-V
75	O-OY	OY-O	OY	Y	Y	Y	GrB	GrB	GrB	P-V
80	O-OY	OY-O	OY	Y	Y	Y	GrB	B	V-GrB	P-V
85	O	OY-O	OY	Y	Y	Y	GrB	B	B-V	P
90	O	O-OY	OY	Y	YG-GrY	GrY	GrB	B	V-B	P
95	O-OY	OY-O	Y	Y	YG-GrY	Y	BG	B	V-P	P
100	O-OR	O	OY	Y	YG	YeG	BG	B	V-B	P
105	O-OR	O	Y	Y	YG	G	BG	GrB	V-B	P
110	O	OY-O	OY	Y	GrY?	BIG	BG	GrB	GrB	P-PR

yellow at 90 degrees; (2) orange follows a similar course; (3) orange-yellow is fairly constant, showing a slight shift, in some cases, toward orange (with D and R), but generally to yellow; (4) yellow is also fairly constant, though it loses its greenish cast and shifts as a rule toward orange-yellow; (5) yellow-green passes rapidly through greenish yellow to yellow; (6) green soon becomes yellow, which is seen only intermittently at the extreme periphery; (7) blue-green quickly shifts to greenish blue and, with some observers (B and T), to blue; (8) blue is intermittently blue or greenish blue throughout the series; (9) violet shifts gradually toward blue, as also (10) does purple. Thus, the change with red, orange, orange-yellow, yellow-green, and green stimuli is toward yellow; while that of blue-green, violet and purple is toward blue.

3. With the Platinum White Background

Table III has been selected as fairly representative of the results obtained with the white background and projection ground. It shows the general trend of the colors. With this background, however, there is greater variability in the observers, and also in the results for a single observer, than with the other two backgrounds. Because of this variability, special additional tables IV-VIII have been prepared, which represent respectively the results from red, orange, orange-yellow, yellow, and yellow-green, for all the observers. (1) Red is fairly constant, changing only slightly in the direction of yellow; (2) orange is almost as constant, but shifts somewhat toward red; (3) orange-yellow changes also toward red, though it only occasionally shifts beyond orange; (4) yellow soon loses its decidedly greenish cast and changes in the direction of red; it almost never, however, shows a shift beyond orange; for G and B it is practically constant, and for the other observers it shifts generally only to orange-yellow; (5) yellow-green passes through greenish yellow and yellow to orange-yellow; for B it then shifts almost to orange; for F it becomes even more reddish; for the others (D, G, and R) it practically remains slightly on the yellow side of orange-yellow; (6) green shifts through yellowish green, yellow-green, and greenish yellow to yellow; it is then usually colorless, but is sporadically seen as orange-yellow, orange, or a color between orange and orange-red; (7) blue-green changes to greenish blue or blue; it is even occasionally seen on the periphery as bluish green; (8) blue is fairly constant; (9) violet becomes blue for all except F, for whom it is sometimes violet; (10) purple likewise becomes blue for all except F, for whom it is

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Stim.=R TABLE IV White Background

Fix'n. °	Observers				
	B	D	F	G	R
90	—		—		—
85	O —	—	—	—	—
80	—		— B?	B	OR —
75	V-B —	R R?	— OR O? O-OR ₂	R?	OR OY
70	O —		OR ₂	—	— O
65	R	R R??	—	O	OR O
60	O-OR O ₂ O-OY		O-R	Y?	V
55	O-OR		OR	R	O ₂
50	OR		OR-O	R	R
45	R		OR	OR	R
40	PR-P		OR	OR-R	R
35	R-PR		OR	OR	R
30	R		OR	OR	R
25	R-OR		R-OR		R
20	R		OR-R OR-R R	R	OR
5	R-OR	R	R	R-OR	R
0		OR	R	R-OR OR	OR-R OR

Stim.=O TABLE V White Background

Fix'n.	Observers				
	B	D	F	G	R
90	—		—		—
85	—	—	—	—	—
80	—		O-OR OR	—	P —
75	— R	O	O-OR,	O or OR? —	O Y
70	OR, R		O-OR OR-O	OY	O — OR
65	OR-O	R	OR-O	O	OR O
60	OR-O		OR-O	O	O
55	O-OR	O	O-OR	O	O
50	OR-O		OR-O	OR-O	OR
45	R		O-OR	O-OR OR	O
40	R-PR R		OR	O	R
35	R		OR-O	OY-O	OR
30	R-OR		O-OR	O-OY	R
25	OR		O-OR		R
20	O OR		R-OR, OR R-OR YG?	O	O
5	OR-O	O	O-OR	O,	O
0		O-OR OR-R	O,	O	O,

Stim.=OY TABLE VI White Background

Fix'n. °	Observers				
	B	D	F	G	R
90	—		—		→
85	— O	?	—	—	→
80	→		O-OR ₂	→	Y P —
75	— O	Y OY-O	O-OR O	OY-Y OY	OY — OY-Y
70	— O		OY-O	O OR-O	OR O
65	O	O	OY-O	OY	OR OY-O
60	O ₂		O-OR	Y	O
55	OY-Y	OY-O	O-OR	OY-O	O
50	O		OR-O	OY-O	OR
45	O-OR		O O-OR	Y-OY	OR
40	O		O-OY	OY-O	O
35	O		O-OR	OY	OY
30	OY		OY	OY O-OY	O
25	O-OY		O-OY		O
20	OY		OY OY-O ₂	OY	OY
5	OY	OY ₂	OY	OY	OY
0		OY	OY	OY ₂	OY ₂

Stim.—Y TABLE VII White Background

Fix'n.	Observers				
	B	D	F	G	R
90	— B		—		—
85	—	—	-Y-?	B? —	— V
80	— Y		— OY?	Y	Y, — O GrY
75	— O	Y-OY	O-OR	Y,	Y GrY
70	Y —		GrY-Y Y	Y	O Y, —
65	Y-OY	OY,	-Y-	Y	O Y
60	Y,		O-OY	Y,	O
55	Y	OY	Y-OY	Y	OY
50	Y-OY		GrY-YG	Y	OY
45	Y+OY		O-OY	Y	Y
40	OY-Y		OY-Y	Y-OY	Y
35	Y		Y-OY	Y Y-OY	Y
30	Y		OY	Y	Y
25	Y-OY		Y		Y
20	Y-OY Y-GrY		YG-GrY YG OY-Y	Y-GrY	Y
5	Y	Y	Y	GrY-YG	Y
0		Y	Y	GrY-Y Y-GrY	Y,

TABLE VIII

Stim.=YG

White Background

Fix'n. °	Observers				
	B	D	F	G	R
90	— R? B?		—		—
85	—	— Y	—	B or P?	—
80	— R		— O-OR O-OY	B?	— Y
75	—	OR-O	— O-OR O? O-OY Y	O	— Y, P-R, O? Y or G
70	O-OY OY O —		OY-Y?, — Y?	Y	— O
65	OY	OY-Y	OR-O, O OY-O GrY or OY	Y	R OY
60	Y OY-O		OY or GrY-YG	Y,	O
55	— Y	Y-OY	-Y-?	Y	OY
50	GrY-YG		YG-GrY	Y	—
45	YG		YG-YeG	Y	YG
40	YG		YG-GrY	GrY	YG
35	YG		YG	GrY	YeG
30	YG		YG	GrY-Y	YG
25	YG		YG		G
20	YG		YeG	GrY	YeG
5	YG-YeG	YG	YG	YG	YG,
0		YG	YG	YG	YG YG-YeG

occasionally violet. Thus, red shows a very slight change toward yellow; orange, orange-yellow, yellow, and yellow-green change in the direction of red; green becomes yellow (possibly reddish); blue-green, blue, violet, and purple become blue.

4. Comparison of Results for the Three Backgrounds

a. Effect on hue

A comparison of the results for the different backgrounds shows that: (1) the effect on red is practically the same with the grey and the white grounds (a slight shift toward yellow); the shift toward yellow is much more marked with the black ground; (2) orange, orange-yellow, yellow, yellow-green, and green all shift toward yellow with the grey and the black grounds, and toward red with the white ground; (3) blue, blue-green, violet, and purple tend to become blue with all three backgrounds; blue-green and blue have, however, a slight tendency to appear greenish blue with the white background; and blue, violet and purple may change slightly toward violet with the black background.

b. Effect on limits for colors

The results give also a rough indication of the effect of background on the limits for the different hues. Table IX gives the estimated mean values for all observers, with each of the backgrounds, of the limits for (a) the 10 colors seen as such, and for (b) the 10 different colors seen (as *Vorfarben*). Considerable variation is shown. With the grey ground the order of extent of the colors is: (a) B, R and OY, O, Y, P, BG, V, G, YG; (b) Y, B, OY, O, R, V, P, BG, G, and YG. With the black ground the order is: (a) B, OY, Y, O and P, G, BG, R, YG and V; (b) B and Y, OY, O and P, BG, G, V and R, YG. With the white ground the list runs: (a) B, R, Y, OY, O and G, BG, V and P, YG; (b) B, R and O and Y, OY, P, V, BG, G, YG. The variations between (a) and (b) are obviously due in large measure to differences in chroma and tint of the colored papers. Comparing the three backgrounds, we find that results from the grey are in general intermediary between those from the black and those from the white. The white ground shows the widest limits for red, orange, and blue-green; the black for the other colors.

c. Comparison with Fernald's Results

The results obtained thus far differ in some details from those of Fernald. (1) Red with the white background is not "more carmine at the outer limits than at the center;" the tendency is rather for it to be, if anything, slightly more car-

TABLE IX
LIMITS FOR COLORS
Backgrounds

Stim.	a			b		
	Grey	Bk.	Wh.	Grey	Bk.	Wh.
R	70	35	75	70	50	80
O	65	70	45	75	70	80
OY	70	75	50	80	85	75
Y	60	85	70	90	90	80
YG	30	30	25	40	40	35
G	40	50	45	40	55	45
BG	50	45	60	45	50	60
B	85	90	80	85	90	85
V	45	50	35	65	60	60
P	55	70	35	60	70	70

mine at the center. (2) Orange-yellow and yellow show in general a less marked change toward red than in Fernald's results; her observers perceived orange-yellow as red as far out as 95 degrees; we seldom found it to change beyond orange; none of our observers saw yellow (as two of hers did) as red on the periphery. (3) Fernald gives no statement of results with yellow-green and blue-green, nor for green with the black background. (4) With the black background, violet and purple were not seen as such at the extreme periphery, as was the case with her observers; instead, they tend to shift toward blue.

5. Results of Mixing Black or White With Colored Stimuli:

Grey Background

Different amounts of black or white, mixed with colored papers on an electric color mixer, were presented as stimuli at all the fixation points, with the grey background, in order that we might determine how far the results with different backgrounds might be duplicated with a single background, by actual measurable physical mixture of colors with light.

In addition to the general shift of color tone from the center to the periphery, the observers reported increasingly at shift in hue of a single color during fixation. There are manifest substantial differences in the number of changes reported, due partly to the fact that such changes were reported earlier in the work by some observers and were not specifically asked for by the experimenter until they had been spontaneously noticed a number of times, and partly to individual differences as regards stability of the colors. Thus B. who seems to have great stability of color, when I told him grey background the color was removed as long as the stimulus within the circle was a color as in periphery but over a minute not less than longer sometimes lasted even longer—sometimes even two changes of stimulating the entire period of observation. C reported that least number of changes. E was a case second. Table I-XII give sample results from different observers on three backgrounds.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

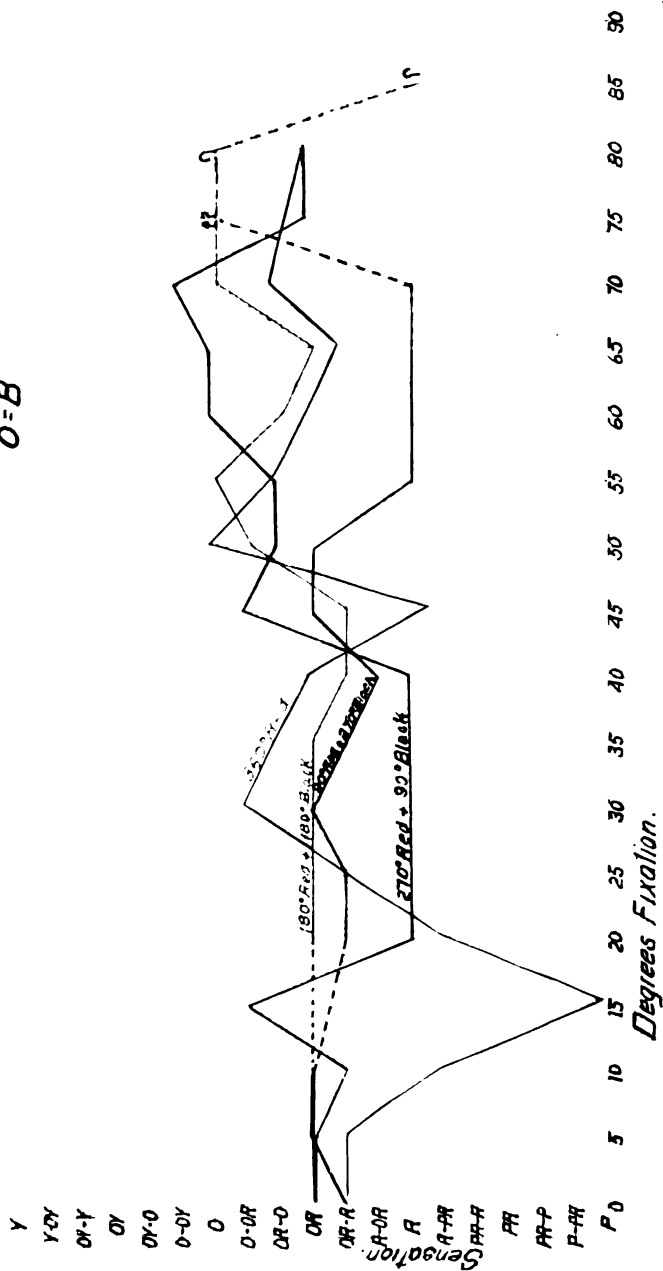
2. Next, it is important to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing data sets.

3. Once the information is gathered, the next step is to analyze it and identify the key factors that influence the outcome. This often involves using statistical methods or other analytical tools.

4. After analysis, the next step is to develop a plan or strategy to address the problem. This plan should be based on the findings of the analysis and should take into account all relevant factors.

5. Finally, the plan is implemented, and the results are monitored and evaluated. This step is crucial for ensuring that the solution is effective and for making any necessary adjustments.

1.
 STIMULUS = RED + BLACK
 BACKGROUND = PLATINUM GREY
 O = B

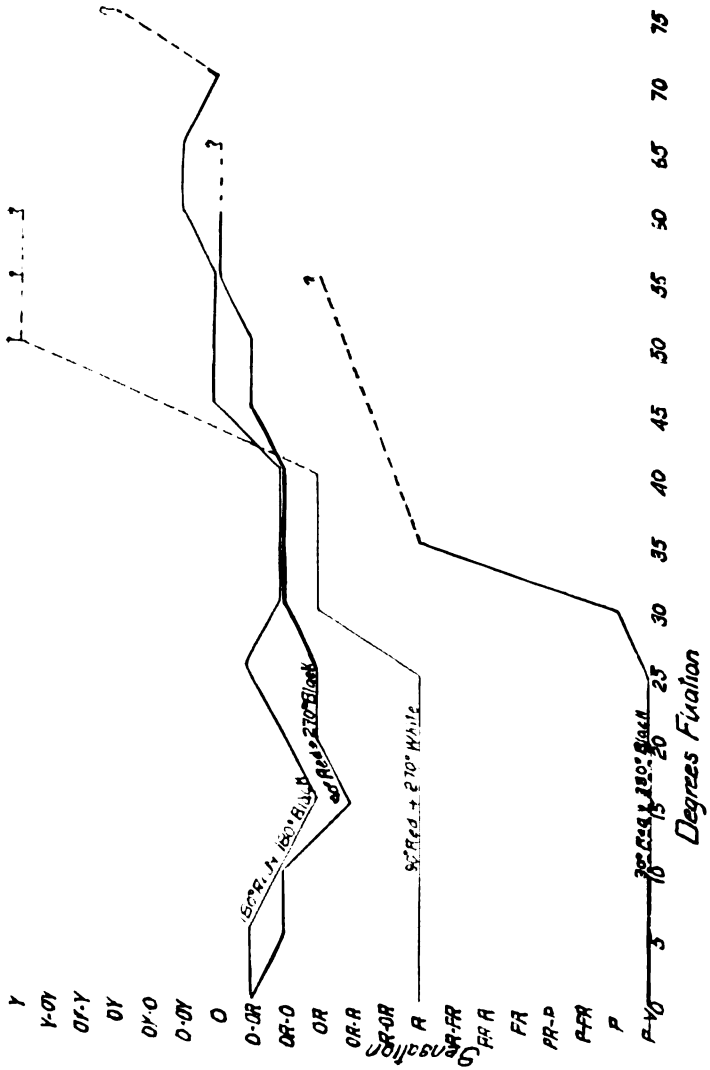


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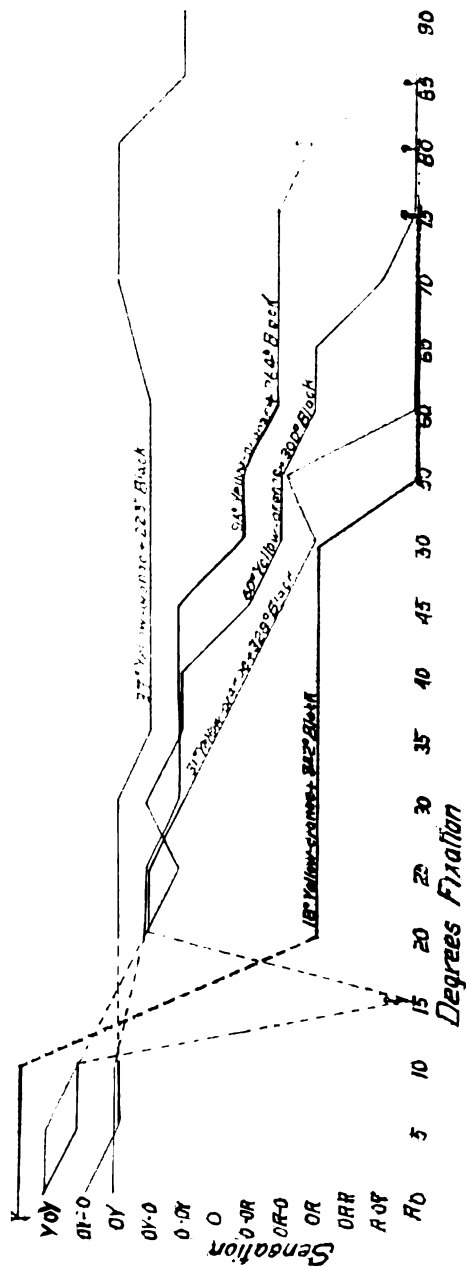
3
 STIMULUS=RED+BLACK OR WHITE
 BACKGROUND=PLATINUM GREY
 O=G

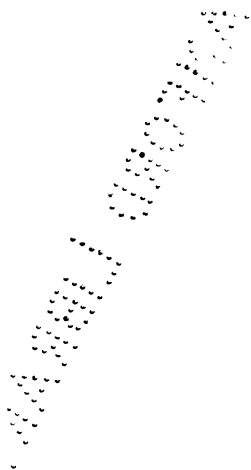


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4.
 STIMULUS = YELLOW-ORANGE + BLACK
 BACKGROUND = PLATINUM GREY.
 $O = D.$





(4) sensations from blue, violet, and purple (seen usually as blue) shift slightly toward violet. The change is, therefore, toward the stimulus color with red, blue-green and violet and purple, and from it with orange, orange-yellow, yellow-green and green. In other words, sensations from red, yellow-green, green, and blue-green shift toward the red end of the spectrum, while sensations from orange, orange-yellow, yellow, blue, violet, and purple shift toward the violet end.

The case is somewhat different with the black background. Here (1) red, orange, orange-yellow, yellow, and yellow-green all change still further toward yellow; (2) green and blue-green are constant (no change was reported); (3) blue shifts toward blue-green; (4) violet and purple change toward blue. Thus, red, orange, orange-yellow, and yellow change in the direction of the violet end of the spectrum; yellow-green, blue, violet and purple shift toward the red end of the spectrum; green and blue-green are constant.

With the white background fewer changes were reported than with the other two. Here the change, when it occurred, was often too rapid for sure judgment of its direction; the colors seen were, moreover, so unsaturated that it was very difficult to pass judgment as to change in hue. In general, however, (1) red, orange, orange-yellow, yellow and yellow-green (all seen as reddish) become decidedly more red during fixation; (2) no change was reported in green; (3) blue-green, blue, violet, and purple all shift somewhat toward purple. Thus, red, orange, orange-yellow, yellow, and yellow-green shift toward red; green is constant; blue-green, blue, violet, and purple shift toward violet.

It was at first thought that these changes in hue might be due to poor fixation. If that were the case, we should expect to find the changes (1) always occurring in the direction of the stimulus, or (2) always occurring in the direction away from the stimulus, or (3) showing irregularity in direction. No one of these conditions, however, is found. Moreover, R gives evidence of occasional faulty fixation, but reports (except twice) no change in hue during the five seconds' fixation. We feel confident, therefore, that these changes represent a normal occurrence.

B. Changes in Tint and Chroma

At the center the colors are seen: (1) with the grey background, as generally medium in tint and good in chroma; (2) with the black background, as light in tint and very good in chroma; (3) with the white background, as dark in tint and

TABLE X

Grey Background

	Fix'n.	Stim.	Sensation	Change
<i>O=B</i>	85	OY	OY-O	vs. Y
	75	OY	OY	vs. Y
		Y	Y-OY	Y
	70	O	O-OY	Y
		OY	Y-OY	vs. Y
		P	V-P	V
	65	R	OR	vs. R
	60	OY	OY	vs. Y
	55	O	OY	Y
		YG	Y-GrY	vs. Y
	45	OY	O	Y
		YG	YG-Y	Y
<i>O=F</i>	85	OY	OY-Y	vs. Y
	80	OY	OY	Y
		YG	Y	vs. Y
		B	B-V	vs. V
	75	O	O-OY	Y
		G	GrY	Y
		R	OR-O	OY
	70	OY	GrY-YG	vs. Y
	65	O	OR	vs. Y
		OY	OR	Y-OY
		YG	GrY-YG	vs. G
		B	GrB	V-B
		O	O-OR	vs. Y
	60	O	OY	Y
	55	Y	OY	vs. Y
	50	O	OR	vs. Y
		Y	O-OY	Y
		Y	Y-OY	vs. Y
		P	P	vs. V
	45	R	OR-O	vs. Y
		OY	OY-OR	YG
		OY	OY-OR	vs. Y
		Y	GrY	Y
		Y	YG-GrY	vs. Y
		P	P	V-P
		V	B	V-B
		B	B	V-B
	40	R	O	OR
	30	R	O	OR
	25	BG	GrB	G-BIG

fairly good in chroma. With all three grounds, the colors become steadily darker and poorer as they approach the periphery. The change in tint is most rapid with the white ground, and least rapid with the black ground. With the latter ground, in fact, the colors become only slightly darker, fading out to

TABLE XI

Black Background

	Fix'n.	Stim.	Sensation	Change
O=B	75	O	O-OR	vs.O
		R	O-OY	vs.Y
	65	Y	OY-Y	Y
	55	O	O	Y
	50	O	O	vs.Y
O=F	90	Y	OR-O	OY-O
	80	R	O-OY	vs.Y
	70	P	P	B
	60	Y	OY	vs.Y
	55	R	OR-R	vs.O
		OY	O-OY	vs.Y
	50	O	OR-O	Y
		O	OR-O	vs.Y
	25	Y	YG-GrY	vs.Y
O=T	90	B	P	B
	80	R	OY	vs.Y
		V	P	B
	75	V	P	B
	65	R	O+OR	vs.O
	45	YG	YG-YeG	Y
	30	Y	GrY	Y
	25			

TABLE XII

White Background

	Fix'n.	Stim.	Sensation	Change
O=B	85	OY	O	OY-Y
	75	P	OR	O
	70	O	OR-O	OR
		OY	O	OR
		YG	OY-O	O-OY
		B	B	P
	65	BG	B	P
	60	R	O	OR-O
		YG	OY-O	OY-Y
		P	B	V-P
	55	R	O-OR	vs.R
	45	P	P	vs.B
	40	R	PR-P	B
	30	V	B	vs.V
	25	OY	O-OY	Y
	20	O	OR	vs.R
O=G	45	R	OR	R
	40	O	O	O-OR
		Y	Y-OY	Y
		P	B	P-V

light grey, while with the white ground they become darker at a rapid pace and pass over into black. The results with the grey ground are, as usual, intermediate; the colors fade into darker greys.

C. Variations in Duration of Sensation

As a rule, the stimuli were exposed for uniform periods of 5 seconds. It was incidentally noted, however, when longer exposures were given, that the duration of the sensations as colored was definitely correlated with the angle of fixation and with the brightness of the background. The black ground is perhaps the most, and the white ground the least favorable to persistence of sensations. With all three grounds adaptation becomes rapid as the periphery is approached. On the more extreme peripheral points the sensations show a tendency toward a flash-like appearance. This tendency is least marked with the black ground, occurring only twice (with D, for green and purple stimuli). With the grey ground, 15 occurrences of "flash" sensations were noted, at fixation points from 70 to 90 degrees, with purple (9 times), red, green, blue-green, and violet. The white ground gives the greatest number, 52 occurrences. Of these, four occur at 90 degrees, four at 85 degrees, thirteen at 75 degrees, eleven at 70 degrees, one at 65 degrees, two at 60 degrees, three at 55 degrees, and one at 50 degrees, with all stimuli, though most often with purple (9 times), blue-green (8 times), and yellow-green (7 times).

II. Effect of Background on After-Image

A. Change in Hue

1. With Medium Grey Background

With the medium grey background, the after-images of: (1) red stimuli change from bluish green at the center to greenish blue or blue, except for R, whose after-images are practically constant (blue-green); (2) orange stimuli change from blue-green (or greenish blue) to greenish blue, and finally, for B and F, to blue; (3) orange-yellow stimuli change from greenish blue to blue; with F and R they even show a tendency to shift toward violet; (4) yellow stimuli are fairly constant (blue), but shift occasionally toward violet for B, F, and R; (5) yellow-green stimuli are violet or purple at the center, but change to blue (they are occasionally greenish-blue at the periphery); (6) green stimuli are constantly purple for B, but shift to violet for F and R, and to blue for D (and

once for F); (7) blue-green stimuli change for B from orange-red to orange-yellow, and for D and R to orange; (8) blue stimuli change from orange-yellow to yellow for B and F, are fairly constant for D, and change to orange for R; (9) violet stimuli change from yellow-green or greenish yellow to yellow for all observers; (10) purple stimuli change from green to yellow for B and R, to orange-yellow for D, and to greenish yellow for F. (See table XIII for typical set of

TABLE XIII

Grey Background

Fix'n.	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
90	B-GrB	—	—	—	B GrB-BG	—	Y	Y GrY-YG ₂ OY-Y GrY	—	—
85	—	B ₂	V-B	B B-V	B-GrB	— B	Y	Y	Y	GrY?
80	GrB	GrB	B-GrB	B-V	B-GrB	—	OR-O	Y	OY	—
75	BG	GrB	V-B	B	B	—	OY ₂	Y	Y	Y
70	GrB	GrB ₂	B-V	GrB B	B	—	Y	Y	Y	GrY
65	GrB-BG ₂	GrB	V-B	B-V?	V	—	OY	Y-OR	Y-GrY	YeG-YG
60	GrB-BG	GrB	V-B	V-B	B-V	V-B	OY	OY	GrY-YG	YG-YeG
55	BG	GrB	B-V	B-GrB	—	V	O-OY	Y	YG-GrY	YG-YeG
50	GrB-BG	GrB	GrB-B	B-V B?	BG V-P	V-B	O-OR ₂	YG-GrY	YeG-YG	YeG YeG-YG
45	GrB BG	GrB	V V-B	V ₂	V	V-P	OR-O	Y	YG-YeG	YG? YG-GrY YeG-G
40	GrB	GrB	V	V-B	V	P-PR	OR-O	OY	YG-YeG	YG-YeG
35	GrB	GrB	V-B	B	V-P	P	O-OR	OY-Y	YG	YeG
30	GrB-BG	GrB	GrB-B	B	V-P	P	O-OR	O-OR	YG	G-YeG
25	BIG	GrB-BG	GrB	B	P-V	P-PR	O-OR	Y-OY	YG-YeG	G-YeG
20	BG-BIG	GrB-BG	GrB	B	P-V	P-PR	O-OR	OY-Y	YG	G

results.) It is evident that there is a good deal of variability in the results; we can, however, indicate certain general tendencies. After-images whose components are blue and green change slightly toward the violet end of the spectrum; green after-images and those whose components are red and yellow shift toward yellow; purple after-images shift toward blue. If, now, we disregard the stimuli and consider the after-images merely with reference to the sensation qualities, we find that after-images of the different sensation qualities are always those that we get with the same sensations in central vision. They all, therefore, change in correspondence with

TABLE XIV

O=D

Black Background

Fix'n. O	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
90	—	—	—	B	BlG?	—	—	—	—	—
85	BlG?	—	BlG?	BlG	—	—	—	—?	—	—
80	— GrB-BG	— ₂	BlG BG-GrB	GrB? —	— G?	— ₂	— ₂	OR-O? R??	— ₂	— ₂
75	—	GrB-BG?	BG-GrB	GrB	—	—	—	OR-O	OR	—
70	BG-GrB	BG-GrB	BG-GrB	B	—	—	—	—	OR?	—
65	BG	BG-GrB	GrB-BG	GrB-BG B	B	—	—	OR-O	OR-O	—
60	BG	BG	BG-GrB	B	B	B	OR-O	O-OR	OR-O	—
55	BG-GrB	GrB	B	B	B P-PR	B	OR-O	OR-O	O-OR	—
50	GrB-BG	BG	GrB-BG	B	B	OR??	OR-O	OR-O	OY-GrY	O-OR
45	B	—	B	B	B	P	OR	O-OR	OY-O+YG	—
40	BlG	BlG	GrB	V	P	P	OR-R	OR+YG	O-G	YG-YeG
35	BlG-G	BlG-G	B	B	P	P	O	OY-O	YG	YG-YeG
30	BlG	BlG	B	B	P-PR	P-PR	O-OR	O-OY	YG	YG-YeG
25	BlG	BlG-BG	B	B	P	P-PR	O-OR	OY-O	YG	YG-YeG
20	BG-BlG BlG	BG-BlG	B-V GrB	B-V B	—	P-PR	OR-O OR-O	OY O	YG	YG-YeG

changes in their sensations, so that they are always the complementary hues to those sensations in central vision.

2. With Black Background and Projection Ground

(See table XIV for representative set of results.) Here we find that the after-images of: (1) red stimuli shift from bluish green to greenish blue, for D, and usually to blue for the other observers; (2) orange stimuli follow a similar course from blue-green to greenish blue with D, F, and Ge, and to blue with B, R, and T; (3) orange-yellow stimuli show great variability, becoming greenish with D, and remaining bluish (occasionally violet) with the others; (4) yellow stimuli show many slight fluctuating changes, so that it is impossible to say more than that they are fairly constant (blue) for all except D, for whom they incline toward green; (5) yellow-green stimuli are constant (purple) for T, and shift to blue or greenish blue for the others; (6) green stimuli shift from purple to violet for R, and to blue for the others; (7) blue-green stimuli shift from orange-red to orange for B, to orange-yellow for Ge, R and T, but are fairly constant for D and F; (8) blue stimuli shift from orange-yellow or yellow to orange-red for B, D, and T, and to orange for F, but are fairly constant for Ge and R; (9) violet stimuli shift from yellow-green or greenish yellow, to orange-red for B, D, and T, to orange-yellow for R, and to yellow for F and Ge; (10) purple stimuli change from green (slightly yellowish) to a hue between orange and orange-red for D and F; to greenish yellow for T; to yellow-green for Ge and R; and are constant for B (for all except D and F they are soon colorless). The general trend is, then, that after-images whose components are blue and green shift toward blue; purple shifts toward blue; orange-red may or may not shift toward yellow; all other after-images whose components are red and yellow or green and yellow shift toward red. If, now, we consider the after-images in relation to their sensations, we find that after-images of: (1) red sensations tend to shift from green or bluish green to greenish blue (or even blue); (2) orange sensations change from blue-green toward and even to blue; (3) orange-yellow sensations tend toward blue from greenish blue; (4) yellow sensations are usually blue or greenish blue; (5) yellow-green sensations are practically always of a hue slightly to the violet side of purple; (6) green sensations change from a reddish purple to a hue between purple and violet; (7) blue-green sensations change from orange-red more or less in the direction of yellow; (8) blue sensations remain constantly yellow

or change in the direction of red; (9) violet sensations change from yellow-green in the direction of red (once even to orange-red); (10) purple sensations tend to shift from green to yellow-green, to orange, or even to orange-red. Thus, after-images are fairly constant only for yellow-green and, possibly, blue and yellow sensations, and sometimes for blue-green stimuli.

3. With White Background and Projection Ground

Table XV gives a sample of the results for one observer. With the white background and projection ground, the after-images of: (1) red stimuli change from bluish green, at the center, to greenish blue for D and F, to blue for G, and to violet for B and R; (2) orange stimuli change from blue-green or greenish blue toward blue, becoming greenish blue for D and R, blue for F and G, and violet for B; (3) orange-yellow stimuli are constantly greenish blue for F, change to blue for D, G, and R (?), and to purple for B; (4) yellow stimuli are constantly blue for D and G, but change to violet for B, F, and R (?); (5) yellow-green stimuli change from purple or reddish purple to greenish blue for D, to blue for G, and to violet or blue for B, F, and R; (6) green stimuli change from red or purplish red to purple or violet (R); (7) blue-green stimuli change from purplish red to yellow for D and G, from purple to yellow-green for R, and from a reddish orange to yellow or yellow-green for B and F; (8) blue stimuli change for B from orange-yellow to yellow, for D and G they are constantly yellow, for F and R they become greenish yellow; (9) violet stimuli change from greenish yellow to yellow for all except F, for whom they change from yellow-green to greenish yellow; (10) purple stimuli change from yellowish green to yellow for all except F, for whom they are always somewhat greenish. The general trend is, then, that after-images whose components are blue and green become bluer (even violet); those whose components are red and yellow shift toward green, and those whose components are green and yellow change more or less toward yellow. If, now, we consider the after-images in relation to the sensation qualities, we find that after-images of: (1) red sensations change from bluish green to blue or even to violet; (2) orange sensations change from blue-green to blue or violet; (3) orange-yellow sensations change from greenish blue to blue or violet; (4) yellow sensations change from blue (or violet) toward violet (or purple); (5) yellow-green sensations are fairly constantly purple; (6) green sensations change from red

TABLE XV

O=R

White Background

Fix'n. °	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
90	— ⁴	— ³	— ³	— ³	— ³	— ³	YG —	— ³	— ⁴	— ⁴
85	— ² V	— ³	— ³	— ³ B GrB ₂ V ₃	— ⁴	— ⁴ Y	— ³ Y	— ² Y GrY-OY OY	Y ₃	— Y
80	— ⁴ BG V	— ³ BG	— BG	— GrY	— ³ V ₂ B	— Y	— ² —	— Y ₂	— ² GrY ₂ Y ₄ GrY ₃	— YG Y
75	BG	GrB	B GrB	V	V ₁₀ B GrB P ₂	V —	GrY	Y	Y ₁₀ — ²	—
70	—	BG	B	BG	B —	—	—	Y	Y ₂ — ³ GrY	— ²
65	V	V	GrB	BlG	—	V	Y	Y	GrY	Y ₂
60	GrB	BG	BG	GrB	GrB	—	Y	Y	GrY	—
55	V BG	GrB	GrB	GrB	V	V	Y	OY-Y	GrY ₃	—
50	BlG	BG	BG	GrB	V	V	Y	Y	Y	—
45	BlG	BG	GrB	B	V	V	O ₂	Y	YG	YeG
40	BlG	BG	BG	B	V-P	P	R	Y	Y	YG
35	G	BG	BG	GrB	P	P	R	Y	GrY	YeG
30	BlG	BG	BG	V	V-P	V	OR	Y	YG	YG
25	G	YeG	GrB	V	P	V	P	Y ₂	GrY	YeG
20	BG	BG	GrB	P	P	P	P	Y	GrY	YeG
5	—	BG	GrB	V	V	—	P	Y	—	GrY
0	BG	BG	BG	V	V	PR	—	Y	Y	YeG

or purplish red toward purple; (7) blue-green sensations change from purple-red or orange-red toward yellow-green; (8) blue sensations are constantly yellow (or become greenish yellow); (9) violet sensations are yellow-green or greenish yellow at the center and shift toward yellow; and (10) purple sensations shift from yellowish green or green to yellow-green or greenish yellow or even to yellow. Thus, the after-images are never constant for their stimuli, and are fairly constant only for yellow-green (purple) and possibly for blue (yellow) sensations.

4. With Black Background and Grey Projection Ground

Table XVI gives the results with the black background and grey projection ground for the same observer (D) whose results with the black background and projection ground are given in Table XIV. It may be sufficient to note that the results are quite different for the two projection grounds, especially for blue-green, blue, violet, and purple stimuli. There is, however, very close agreement with the results for the grey background and projection ground.

TABLE XVI

Fix'n. °	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
90	GrB	GrB?	B?	B	GrB?	—	Y?	OY Y	OY	—
85	GrB	GrB	B GrB-BG	GrB?	GrB	—	Y-OY	OY	O-OY	Y-O
80	GrB	GrB	GrB	GrB	BG	—	OY-O	Y	OY	Y
75	GrB	GrB	GrB	GrB	GrB-BG GrB	—	OY	OY-O OY	OY	Y
70	GrB	OY	GrB	B GrB-B	GrB ₂	—	OY-O	Y-OY OY	Y	Y?
65	GrB-BG	B-GrB GrB-BG V-P	GrB ₂	GrB	GrB-BG	—	Y Y?	Y-OY OY-O	GrY	—
60	BG-GrB	GrB	B GrB	B GrB	B	—	OY+GrY	Y-OY	Y	Y

5. With White Background and Black Projection Ground
(See Tables XVII and XV for sample results with this

TABLE XVII

Fix'n. O=R	Stimuli									
	R	O	OY	Y	YG	G	BG	B	V	P
85	—	—	—	—	—	—	—	—	—	—
80	—	—	—	GrB B	—	—	—	—	—	—
75	BlG	B	GrB	B	—	—	—	—	—	—
70	GrB	B	B	B _s	—	—	—	O	—	—
65	GrB	B	GrB	B	GrB	—	—	O	—	—

method, and with the white background and projection ground.) As in 4, the results seem primarily dependent on the brightness of the projection ground. Here, the blackness of the projection ground is, evidently, enhanced by contrast with the white background; quite consistently, we find the results in this case showing an exaggeration of those with the black background and projection ground.

6. Comparison of Results for 1-5

A comparison of the results for the various combinations of background and projection ground brings out, first, the very evident fact that it is the difference in brightness of the projection ground that is responsible for the difference in the courses of the after-images. It is plain also that the after-image hues show the same dependence on brightness that the same hues do when experienced as sensations. If, however, we try to find a definite correlation between stimulus or sensation (or both) and after-image for all backgrounds, we find an apparent lack of uniformity. In the case of the grey ground alone is there anything like consistency. Here we see that the hue of any after-image may be incidentally the complement of its stimulus, but is *always* the complement of its sensation. The medium grey thus seems to present a standard set of conditions with which to compare those of the black and white grounds. Dealing first with the black ground,

as compared with the grey, we note that the most peripheral after-images of: (1) red stimuli (bluish green at the fovea) are slightly greener; (2) orange stimuli (blue-green) are practically the same (slightly greener); (3) orange-yellow stimuli (blue) are as a rule greener; (4) yellow stimuli (blue) are practically the same (possibly greener); (5) yellow-green stimuli (violet or purple) are practically the same; (6) green stimuli (purple) are practically the same (possibly bluer); (7) blue-green stimuli (orange-red) are redder; (8) blue stimuli (orange-yellow or yellow) are redder; (9) violet stimuli (yellow-green or greenish yellow) are redder; (10) purple stimuli (yellowish green) are redder. We find, on the other hand, if we compare the results for the white ground with those for the grey, that, for the former, the most peripheral after-images of: (1) red stimuli (bluish green) are redder; (2) orange stimuli (blue-green) are slightly redder; (3) orange-yellow stimuli (between greenish blue and blue-green) are practically the same (usually redder); (4) yellow stimuli (blue) are perhaps redder; (5) yellow-green stimuli (purple) are redder; (6) green stimuli (purple) are redder; (7) blue-green stimuli (orange-red) are distinctly greener; (8) blue stimuli (orange-yellow or yellow) are distinctly greener; (9) violet stimuli (yellow-green or greenish-yellow) are greener; (10) purple stimuli (yellowish green) are perhaps greener. The results from the black and white grounds are thus seen to show opposite trends with reference to the grey background. They seem, moreover, to correspond closely with the results that ensued in the case of the sensations, where: (1) darkening of the stimuli made red, orange, orange-yellow, yellow, yellow-green, and yellowish green all shift toward red, and made bluish green, blue-green, blue, violet, and purple all shift toward green; while (2) lightening of the stimulus made red, orange, orange-yellow, yellow, yellow-green, and yellowish green all shift toward green, and bluish green, blue-green, greenish blue, blue, violet, and purple shift toward purple. In other words, darkening sensations or after-images makes them shift toward the red end of the spectrum, lightening causes a shift toward the violet end. Taken as a whole, the results suggest that (1) we have in every case, no matter what the brightness of the background may be, the same processes in the retina for a given stimulus at a given fixation (namely, the processes resulting with use of the medium grey background); that (2), however, the simultaneous occurrence of the black or white process results in a tendency for the colors experienced to shift in a definite spectral direction.

It is hardly possible to compare our results with those obtained by Fernald, since these are given in too little detail. We must assume, from such statement as she makes, that her concern with them was comparatively slight; and we think that her method was evidently not calculated to bring out fine details.

7. Effect of Changing Brightness of Projection Ground for the Same After-Image

(See Table XVIII for results.) This method was not always successful, in that sometimes the double movement across the field was distracting, and therefore only one after-image was noted. When, however, the two colored after-images were obtained, they showed changes in hue which were characteristic for their projection grounds. Thus, when the change is from a light to a dark background, the after-images whose components are blue and green shift toward green, those whose components are red and yellow shift toward red, as also do those whose components are yellow and green. A consistent change in the opposite direction occurs when the change of background is from dark to light. These results are also consistent with the view that the same retinal processes for color occur even when the resulting sensations or after-images are different.

8. Changes During Fixation

As in the case of the sensations, so the observers showed a tendency to report changes in the hue of the after-images during fixation. Sometimes the after-images which fluctuated recurred as different in hue; often, also, persistent after-images underwent a gradual change in color tone. Tables XIX-XXI give typical results. Here, as with the sensations, the changes are fairly consistent for given projection grounds. With the white background they occur only with the red, orange, orange-yellow, yellow, and yellow-green stimuli; the shift is always toward the red end of the spectrum. There is less uniformity in the cases of the grey and black backgrounds; though this result may be due to the poorer saturation of these after-images, and to the correspondingly greater difficulty of judging changes in hue. In general, however, with the black background, the after-images of red, orange, orange-yellow, yellow and (usually) yellow-green stimuli shift toward the violet end of the spectrum; and those for green, blue-green, blue, violet, and purple stimuli change toward the red end of the spectrum. With the grey background, after-images of red, orange, orange-yellow, yellow, and yellow-green

stimuli shift toward the red end of the spectrum; and those for green, blue-green, blue, and violet shift toward the violet end. Thus, with the white background, after-images on the green-blue-violet half of the spectrum shift gradually toward the

TABLE XVIII

Grey Background

O	Fix'n.	Stim.	Sensation	After-images		
				Grey P. G.	Black P. G.	White P. G.
D	85	Y	OY	GrB-BG	(1)BIG	
		P	B?	(1)Y	OY	
	80	R	O-OY	(1)GrB-BG	BG??	
		OY	Y	GrB	(1)BIG	
G		B	B	OY-Y		(1)Y?
D	75	O	OY-O	(1)GrB	BG-GrB	
	70	OY	OY-Y	(1)B	BG?	
		YG	Y	GrB	(1)GrB-BG	
		B	B		OR	(1)Y
R		O	OY-O	PR?	(1)V?	
B	65	V	B	(1)GrY-YG	OR	
		V	B	GrY-YG	R-OR	
D		V	B	Y-GrY?	(1)OR	
		V	B		OR	(1)GrY
		BG	GrB-BG	(1)GrY	(1)OR-O	Y?
		BG	GrB-BG	YG?	R-OR	
	60	BG	GrB-BG		(1)OR	
		YG	OY; GrY-YG	OR	OR	(1)Y
F		B	B	GrB-BG	GrB-BG	(1)P-V
B	55	YG	Y	O(-OR)	(1)OR-O	
		O	OY-O	BG		(1)B(-V)
	50	B	GrB	GrB	(1)BG	
	45	B	B	OY	OR(-O)	
		B	GrB	Y-OY		(1)GrY
		B	B		O	(1)Y
D		P	P	(1)YG-GrY	(1)O	
		YG	YG-GrY	(1)P-V	OR-O	
	40	YG	Y-GrY	P-V	B	
		YG	GrY-Y	(1)P-V	(1)B	
G		B	B	Y	GrB-BG?	
		B	B	(1)Y	(1)O-OR	
		B	B		OR	(1)Y
		B	B	O	OR	(1)Y
		V	B	(1)Y	OR	
		P	P-PR		Y-GrY	(1)Y
	30	P	P	(1)YG		Y?
		P	P	YG	(1)G	
B		G	G-BIG	PR	(1)P-PR	
F	25	YG	YG	PR-P?	(1)V-P	
	20	O	OY-O	BG	(1)BG-BIG	

red end of the spectrum; the others are presumably constant. With the grey background, after-images on the green-blue-violet end of the spectrum shift similarly, though less markedly, toward the red end; those on the red-yellow-green half shift toward the violet end. With the black background, after-images on the green-blue-violet half of the spectrum change toward the violet end; those on the red-yellow-green half shift toward the red end. Inasmuch as the chroma of the after-images always becomes poorer, it is conceivable that the difference in results for the white and black grounds as compared with the grey is due to the difference in direction and amount of the change in brightness (which is, of course, toward middle grey).

B. Changes in Tint and Chroma

The tint of the projection ground has a marked effect on the tint of the after-image. All observers show the same general trend. The after-images are lightest with the white background and darkest with the black. With the grey ground they are about medium in tint at the center (those for green, blue-green, blue, violet and purple are rather lighter), and become slightly lighter; with the white ground they are light, and grow steadily lighter; with the black ground they are dark (with the same variations as with the grey), becoming darker toward the periphery.

As regards chroma, the results hardly warrant more than the

TABLE XIX

Grey Background

	Fix'n.	Stim.	Sensation	A. I.	Change
O=D	85	OY	OY-O	B	GrB-BG
	80	OY	Y-OY	B-GrB	vs.G
	70	OY	OY-Y	B	GrB
		O	OY...O	B-GrB	BG-GrB
		YG	OY-Y	GrB	BG
	65	YG	Y	B	GrB
		OY	OY-Y	B	B-GrB
	60	OY	OY-O	B	GrB
		Y	Y	B	GrB
O=R	70	B	GrB	OY	O
	65	O	O-OR	B	P-V
	60	YG	Y	BG	V
	55	BG	B	O	OY
		G	Y	B	V
		Y	Y	B	BG
		OY	O	B	GrB

statement that the black ground is least favorable to peripheral after-images. The white ground appears to be most favorable to peripheral after-images, especially to those from blue stimuli. The observers show decided individual differences with regard to chroma; thus R's after-images are comparatively good, while F's are always poor.

TABLE XX

Black Background

	Fix'n.	Stim.	Sensation	A. I.	Change
O=B	50	YG	Y	B	P
	35	Y	Y	P-PR	V
		YG	Y	P	B
	30	R	R	G	B?
		O	O-OR	BIG	BG-GrB
		Y	Y	B	V-B
		YG	Y-OY	P	V
	25	O	O-OR	G	BG
	20	YG	YG	P	V-P
O=D	55	YG	Y	B	P-PR
	50	V	V-GrB...P	OY	GrY
	45	V	B-V	OY-O	YG
	40	P	P	YG-YeG	BIG
		O	O-OY	BIG	YeG
		OY	OY	GrB	YeG
	35	BG	BG	O	OR
		R	O-OY	BIG-G	GrB-BG
		YG	YG-GrY	P	V
	30	OY	OY	B	BG
		G	YeG	P-PR	B?
	25	B	GrB...BG	O	OR
		G	GrY-YG?	P	B?
	20	B	GrB...BG	OY	OR
		P	P-PR	YG-YeG	YG

TABLE XXI

White Background

	Fix'n.	Stim.	Sensation	A. I.	Change
O=D	80	Y	OY	B	GrB
	75	Y	Y-OY	B	GrB-BG
	65	YG	OY-Y	GrB	BG
		OY	O; OR	GrB	BG
	55	Y	OY	GrB	BG
		R	OR	B-GrB	GrB-BG
		YG	Y-OY	B	GrB-BG
		OY	OY-O	B	GrB

C. Frequency of After-Images

The observers show considerable variation in respect to the frequency with which colored after-images follow colored sensations. With R the occurrence is practically universal; with the black background, however, about five *per cent.* of his color sensations fail to be followed by colored after-images. The other observers show a slightly greater number of such failures. Inasmuch as the work with the black background was done almost entirely in the summer, under the best possible conditions of illumination, it seems evident that for our observers, at least, the black background is less favorable than the others to colored after-images. The grey background supplies the most favorable conditions, *i. e.*, gives the largest *per cent.* of colored after-images.

Inasmuch as our results (though they agree with those of Fernald) are, in this respect, at variance with those of Ferree and Rand, we give here the further support to our view obtained by the additional tests. We adopted a fixation-time of 2 (sometimes 3) seconds, and, keeping the procedure otherwise as before, required the observers to fixate the black ground either 5 or 10 seconds before exposure of the stimulus. The result showed some reduction in the saturation of the sensations, but always a correspondingly greater reduction in the after-images. We then, in addition, omitted all preparatory signals (on the assumption that this might possibly have been the Bryn Mawr procedure); the after-images suffered, however, as much as, if not more than, the sensations. In every case, the observers reported that the sensation was unquestionably and decidedly more saturated than the after-image. We then reduced the chroma of the stimulus by gradual addition of white, until the color passed below the limen. As before, the after-image was affected even more than the sensation, until the stimuli were so reduced that it became merely a matter of guessing for both sensation and after-image. We are forced, therefore, to hold to the belief that the black background is the least favorable for after-images.

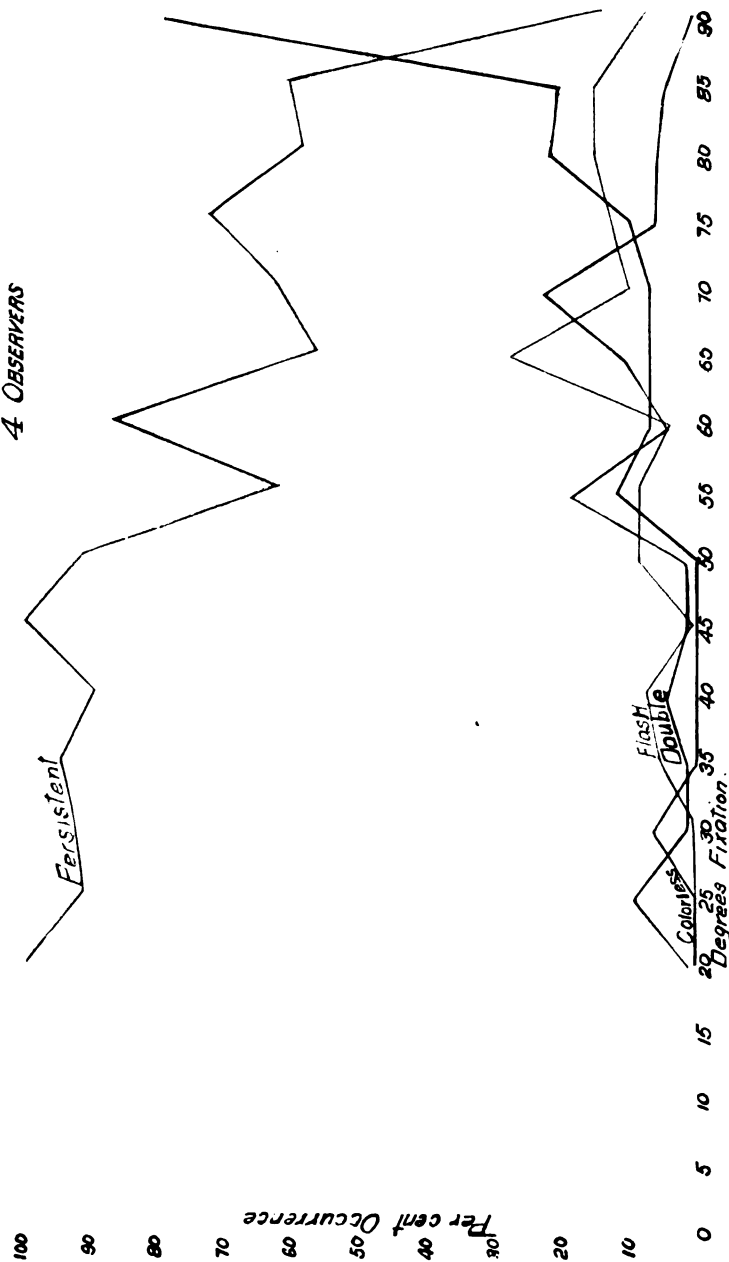
D. Types of After-Images

As with the sensations, the brightness of the background has a distinct influence on the duration of the after-images. It has been shown that there are two types of color sensation, designated as the "flash" and the "persistent" sensation, and that the "flash" type tends to occur at the more peripheral points, and most frequently with the white background, the

ground least favorable to color-sensations. In the case of the colored after-images we also find the two types, the flash-like and the persistent; and, in addition, a third type of occurrence which will be called that of "double" after-images. The double after-images are a succession of the flash and persistent types, occurring with a single stimulus. Figures 5-7 give a graphic representation of all types of after-images occurring with colored stimuli for each background (flash, persistent, double, and colorless). The values given are the estimated mean *per cents.* of occurrence for all observers. It will be seen that: (1) the flash-like after-images occur most frequently at fixation points of from 55-65 degrees; they are reported most often with the black background and least often with the white; (2) the persistent after-images occur most frequently with the grey background, slightly less often with the white ground, and least frequently with the black; they are most frequent at the fovea and least at the periphery; (3) the double after-images occur rarely except with the black background; here they attain an early maximum and then rapidly decrease; (4) the black ground gives the largest number of colorless after-images until a fixation of 65 degrees is reached; from that point on, the increasing number of colorless sensations with the white ground causes a corresponding increase in the number of colorless after-images reported. There is marked individual variation in the frequency of occurrence for the different types. D has the largest number of flash after-images; R, all of whose color sensations are persistent, reported no flash after-images. R and F reported almost no double images.

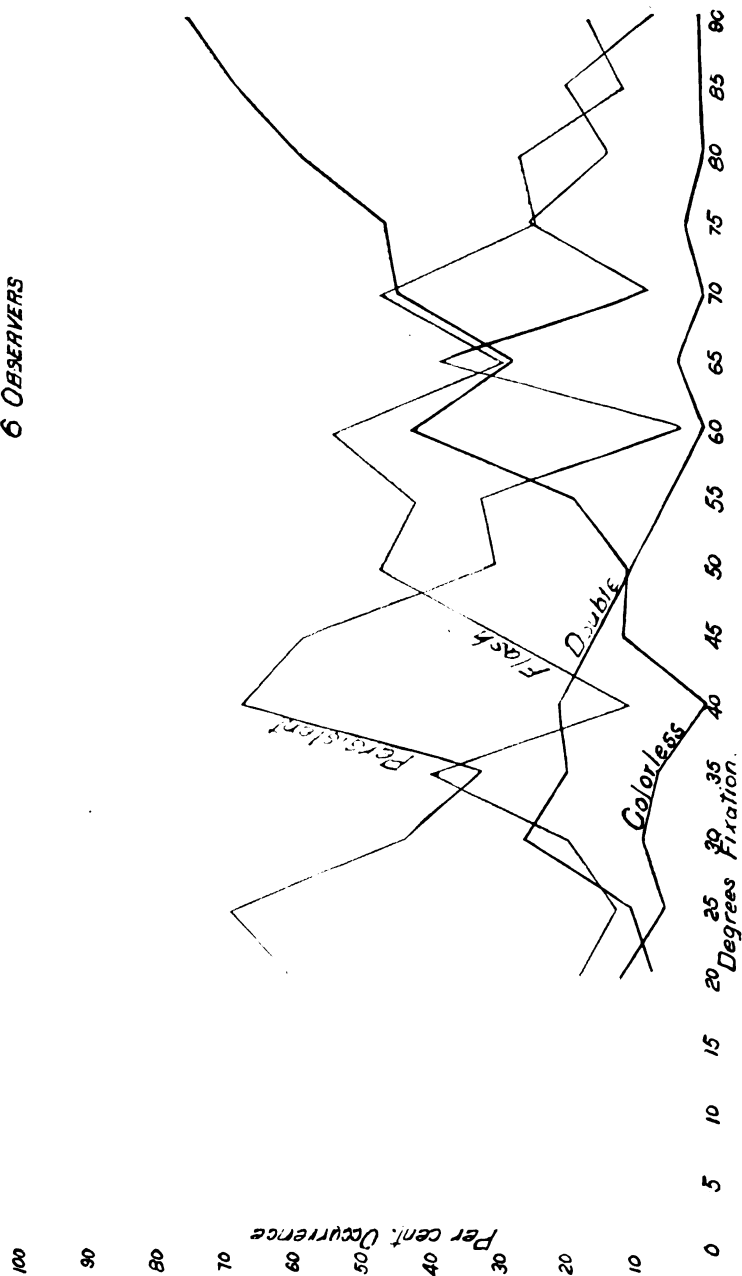
Flash after-images were experienced with all stimuli, but most often with those that were seen colored farthest out. The fact that they were experienced in a uniform way, most frequently, both as sensations and as after-images, with the least favorable backgrounds, seems to suggest that they are not the result of eye movement, as might at first be assumed. It seems more likely that they are in some way dependent on the movement of the projection screen across the field of the stimulus. They occur, subjectively, simultaneously with the perception of this movement. They occur, moreover, under conditions which are unfavorable to color experiences, that is, most often with the least favorable backgrounds and fixation points. They are experienced most often for the part of the visual field that is most sensitive to movement. It is, therefore, conceivable that the rapid but not instantaneous movement of the screen heightens in some way the otherwise subliminal value of the stimuli.

*DISTRIBUTION OF TYPES OF AFTER IMAGES
BACKGROUND=PLATINUM GREY.
4 OBSERVERS*

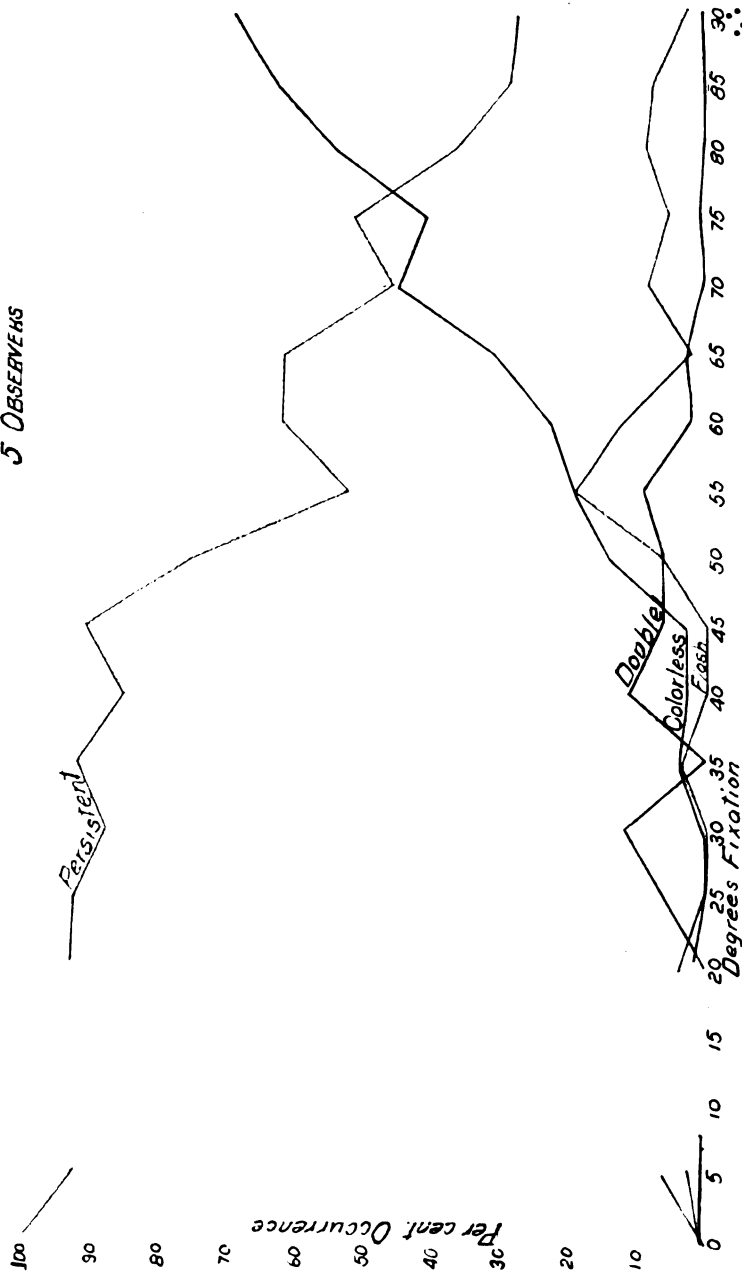




6.
DISTRIBUTION OF TYPES OF AFTER-IMAGES
BACKGROUND=HERING BLACK
 6 OBSERVERS



7.
DISTRIBUTION OF TYPES OF AFTER-IMAGES
BACKGROUND=PLATINUM WHITE
5 OBSERVERS



11

III. *Anomalous Results*

A. General Classification

Along with the consistent and uniform results, there were reported a number of apparently anomalous occurrences. In this class we have included, perhaps too arbitrarily, such types of occurrence as: (1) colored sensations from colorless stimuli; (2) colored after-images from colorless stimuli; (3) colored after-images from colorless sensations; (4) other cases of anomalous hues reported with colored stimuli; and (5) all instances of colors seen during the fore-period of a given observation.

We will consider first those cases in which the anomalies occurred with colorless stimuli. These were reported with all backgrounds, on both bright and cloudy days, for all observers except Ge. With the grey ground 22%, with the black 6%, and with the white 9% of the total number of colorless stimuli gave colored sensations and after-images (these might or might not be complementary). The *per cents.* are 3, 15 and 12 respectively (for the three backgrounds), for reports of colored sensations and colorless after-images; and 3, 9, and 10 respectively, for reports of colorless sensations and colored after-images from these stimuli. We find, then, adding the *per cents.* for the three varieties, 28% anomalies with the grey ground, 30% with the black ground, and 31% with the white ground. There are, furthermore, a number of reports of color seen while the observer was resuming his fixation, or waiting for the stimulus to be exposed.

Greater in actual numbers, but smaller in *per cent.* of frequency, are the apparent anomalies with colored stimuli. These, also, occurred with all three backgrounds, with both good and poor illumination, and with all observers except Ge. Least conspicuous (because it is here difficult to say where normal variation stops and anomaly begins) are the cases where the hue of a sensation could definitely be called "queer." A number of instances were noted, however, where the sensation is distinctly "off color" for the given stimulus and background; where, for instance, the hue is one not normally seen at such eccentricity; and several others suggest that possibility. Much more frequent are cases where a colored stimulus is followed by a colorless sensation but a colored after-image. It was for these "colored after-images from subliminally colored stimuli" that we were especially on the look-out. We got them in greater numbers, perhaps, than Fernald, and certainly under more diverse conditions. They were reported, not only with

the white background under the full illumination, but with the other backgrounds, and with poor illumination, as well. The frequency was practically negligible with the black ground, but amounted, with the grey ground, to $\frac{1}{2}\%$, and with the white ground to 6% of the total number of tests. (Our recent tests with the black ground give added confirmation to these results) : see p. 569. There were marked individual differences ; the *per cent.* was highest for R and lowest for D and G. For no observer, however, was the percentage of frequency so high as in the cases where the "anomaly-inducer" was a brightness.

B. Possible Explanation

If these phenomena are not to be left in the class of anomalies, we must find some adequate and controllable cause for them in the conditions of the experiment. We must at least suggest a reasonable explanation.

1. Negative Evidence

We find ready a possible explanation for the numerous slight irregularities in the reports. The haphazard nature of the series as given, though an aid in eliminating expectation, is, evidently, not calculated for smoothness of results. The rapid change in hue during fixation, for the more peripheral points, introduces further irregularities. Suppose an observer's attention to be lagging at times ; he may then easily misapprehend an intermediate stage in the transition of hue as the first hue seen and report it as such. Some of the colors, moreover, were experienced as such brief flashes that it was very difficult, as F put it, "to fix them." They must last a certain time, he said, in order to be labelled. In such cases, it is clear, a momentary lapse of attention might be fatal. There is, too, the additional difficulty that the poorer chromas are proportionately more difficult to "place" as to hue ; it is obvious that a dark, poor green, for example, is much closer to yellow and blue, on the color pyramid, than is a saturated medium green.

Closely related to the difficulty of distinguishing hues, when the chroma is poor, is the difficulty of assigning names. The name "white" designates a brightness quality, that of "yellow" a color. If, in everyday experience, we have a luminous white, we may call it a "sunlight effect," and it is six of one and half a dozen of the other whether we mean to term it white or yellow. Many of the yellows and whites experienced with the white background were of this dubious sort. They were distinctly luminous, possibly as the result of the movement of

the white screen. D and G explicitly, and the other observers less so, found it difficult to make the decision, in such cases, as to color or brightness. G frequently reported, "It's white with a luminous effect" or "It's a sunlight effect." Sometimes she would decide that she ought to call it yellow, sometimes white, though she admitted that it was always the same. D, under the same stress, would make a decision at one time, and then, later, when the experience recurred, would decide that the earlier decision should be reversed. So the other observers would report "white," and often, after an interval, ask to have the record changed. Sometimes, to be sure, the change of opinion would be due to recollection of a forgotten experience; but usually it issued from a real doubt as to what to call the experience. Other experiences besides yellow gave difficulty in naming. B found it difficult, when the grey background was used, to distinguish the grey of the ground (if presented as a stimulus or used as a projection ground) from a blue-green of medium tint and extremely poor chroma. He repeatedly made this error in naming at times when there was no possibility of color adaptation. He afterwards admitted, on being questioned, that it was a common confusion for him. R and, to a less extent, F were apt to see the slightly darkened white of the projection ground, as they experienced it when somewhat adapted to it, or when it was darkened by the superposition of a colorless after-image, as a very light, poor violet or purple; they reported this experience even when all precautions were taken to secure achromatic adaptation.¹⁰ F would sometimes say, "It's one of those cases where you'd be hanged if you know whether to report color or not." And R declared his judgments in such cases to be worthless. These hesitations about naming make us doubtful of any reports in which they occurred.

It is evident, however, that such suggestions as are here offered would by themselves be scarcely convincing. But we find very definite evidence of the anomalous character of the reports so labelled, in the influence of the previous colored stimuli. In the cases where the hue reported is an "impossible" one, we find that it can be identified with the hue of the previous after-image. Thus, for example, F reports, with the

¹⁰ This experience of purple or violet under apparently achromatic adaptation was provokingly frequent and insistent,—so much so that it seemed to be independent of external chromatic conditions. Prof. Titchener states that it gave trouble before in the work with the peripheral retina. Its recurrence in spite of all precautions seems to indicate that it is due to intra-ocular conditions.

grey ground, "yellow-green," when the stimulus was orange-yellow; we then find that the after-image of the preceding sensation lay between a yellow-green and a yellowish-green. Or, we have a grey reported as blue, and we find that the preceding after-image (or sensation) was blue. The reports of colored after-images with colorless sensations are to be classed, in this respect, with the reports of color with colorless stimuli. In practically all the cases (enough to make us sceptical as to the rest) we find evidence of the influence of the previous colored stimulus. It is perhaps, moreover, a significant fact that the large majority of such anomalous occurrences were reported at the beginning of the experimental hour.

2. Positive Evidence

Thus far our evidence has been mainly negative. We also sought for positive proofs. We selected influence of previous stimuli and variability of attention as controllable factors and tried (1) varying the direction of the attention and (2) varying the time-interval between tests, using in both cases the white background.

a. Change in the Direction of Attention

When the attention was on the stimulus rather than on the after-image, the number of colored after-images reported with colorless sensations was reduced, though some still occurred. When, on the other hand, the attention was directed to the after-image rather than to the sensation, the number of such anomalies was fully doubled. While these results are probably conditioned to some degree upon a central or 'subjective' factor, they are certainly due in large measure to the lapse of accommodation or the gross eye-movement which ordinarily accompanies relaxation of attention. As the method does not allow us to discriminate central and peripheral conditions, we must leave the facts in the rough, remarking only (1) that they should be borne in mind in any attempt to appraise Fernald's results, since she makes no reference to control of attention, and (2) that they are in agreement with previous results for B and R, when with the grey and white grounds respectively, under admitted unpleasant emotional distraction, the number of anomalous reports had been markedly increased.

b. Change of Interval between Tests

When the interval between tests was cut down to one minute or less, anomalies became the rule rather than the exception. An increase in the time-interval had the opposite effect. For B and F an interval of six minutes was sufficient to eliminate

them; R, who (as has been mentioned) was especially sensitive to color and adapted slowly, required, with the white ground, fully a ten-minute interval for complete achromatic adaptation; and even then he continued to report violet or purple with a white stimulus. Despite such occasional irregularities, the result of increasing the time-interval was so constant as to tell convincingly against the acceptance of these occurrences as normal.¹¹

IV. Determination of *Urfarben*

While the work in determination of the *Urfarben* was yet in its early stages, it became evident that the present method was inadequate for exact results. The chief difficulty, aside from that of securing constant illumination, was the fact that a large number of fixation points were required. If these were much closer together than 5 degrees, steady fixation was difficult, and the results were correspondingly variable. We contented ourselves, therefore, with ascertaining that, even with adequate apparatus, the *Urfarben* would be constant only with the grey background; with the other backgrounds there is a uniform shift in a definite spectral direction. Fernald's statement that the *Urfarben* found with the grey ground hold for the black ground as well is probably due in part to the admitted hastiness of this part of her work; in part, also, to the fact (evident throughout her report) that she constantly neglected the smaller details and ignored slight changes in hue.

CONCLUSIONS

I. Critique of Method

As the result of our work with Fernald's method we are led to the following criticisms:

(1) It is an advantage, no doubt, to keep the eye stationary during the presentation of a stimulus. It is, however, a disadvantage to use a moving screen to cover the stimulus. For some observers it is a noticeable distraction; for all it may lead to a variation in conditions, since on the extreme periphery it may be more influential than nearer the center in heightening the effect of a weak stimulus.

¹¹ In the regular series, undertaken to test Fernald's conclusions, the anomalous after-images were, as we have said, likely to occur at the beginning of the experimental hour; not infrequently the very first observation yielded the anomalous result. In these test-series, with change of interval, a time of variable duration was allowed for preliminary achromatic adaptation; with sufficient time-allowance (up to about 10 min.) the initial anomaly disappeared.

(2) The apparatus is poorly adapted to fixations at less than 5-degree intervals from one another. For exact quantitative results it is, therefore, unreliable.

(3) The method may be improved by using, as we did, the Hering head-rest or some other like arrangement which provides for a constant position of the eye, for all fixation points, without thereby involving the slightest eye-strain.

(4) For satisfactory, reliable results, the interval between successive tests must be longer than two minutes. While this interval may be long enough for some observers, with the black background, it is certainly not enough with the white background. For highly sensitive observers, and the white background, nothing short of a 10-minute interval is adequate.

II. The Question of Anomalous After-Images

Inasmuch as it was one of the main objects of these experiments to investigate the occurrence of "colored after-images from subliminally colored stimuli," it may be well to give in some detail a summary of our conclusions.

(1) The frequency of these anomalous colored after-images was considerably less than that for like anomalies with colorless stimuli.

(2) Previous stimuli were found to influence the hue of succeeding sensations, as well as of succeeding after-images.

(3) Colors were seen during the fore-period of tests, after an interval of over two minutes.

(4) The number of anomalous after-images was increased when the attention to them was greater than to the corresponding sensation; the number was decreased when the attention was predominantly directed to the stimulus. We attribute this result, in the main, to changes of accommodation and to eye-movement.

(5) The frequency of their occurrence was increased as the interval between the tests was shortened, and was correspondingly decreased as the interval was increased. *An interval of ten minutes was found adequate, with the white background, for the most sensitive observer, to eliminate entirely such anomalies.* They had occurred in 6% of the observations of our regular series.

(6) Anomalous after-images occur, on the average for all observers, in only $\frac{1}{2}\%$ of our regular observations with the grey background, and with negligible frequency when the black background was employed.

III. General Summary

A. The medium grey background gives us a standard account of the changes which color phenomena with the ten colored stimuli undergo, from the fovea to the periphery. We find that: (a) the sensations from: (1) red, orange, orange-yellow, yellow, yellow-green and green stimuli, shift toward or to yellow; while (2) blue-green, blue, violet, and purple stimuli, shift toward or to blue; and (b) the after-images from: (1) red, orange, orange-yellow, yellow, yellow-green, and green stimuli, shift toward or to blue; while (2) blue-green, blue, violet, and purple stimuli, shift toward or to yellow. The change in hue of the after-image is always such that the after-image is the complement of the sensation.

B. 1, Whenever the sensations or after-images are darkened, by (1) contrast with the white background, (2) the mixture of black with the stimuli, (3) the superposition of dark after-images on the sensations, (4) the projection of the after-images on a dark ground, or (5) the projection of after-images, already in course, on a light ground; then, always, there is a shift in hue in the direction of the red end of the spectrum.

2. Whenever the sensations or after-images are lightened by any of these five means, then, always, there is a shift in hue in the direction of the violet end of the spectrum.

C. Sensations and after-images have been found to change in hue during fixation. With the grey ground: (1) the sensations from orange, orange-yellow, yellow, yellow-green, green, and blue-green shift toward yellow; those from blue, violet, purple, and red shift toward red; (2) the after-images of red, orange, orange-yellow, yellow, and yellow-green shift toward green; those from green, blue-green, blue, violet, and purple shift toward green in the other direction. With the black ground, sensations and after-images from red, orange, orange-yellow, yellow, and yellow-green shift toward violet, those from green, blue-green, blue, violet and purple shift toward red, in comparison with those on the grey ground. The spectral direction is exactly the opposite with the white ground.

D. Different types of color sensation and after-image have been found. In the case of the sensation: (1) the "flash" type occurs chiefly with the white ground at the more peripheral points; (2) the "persistent" type is found at all other points. As regards the after-images: (1) the "flash" type

occurs most frequently with the black background on the periphery; (2) the "persistent" type occurs most often with the white and grey grounds; (3) the "double" type, never frequent, is most often reported with the black ground; (4) colorless after-images are most frequent with the black background and least with the grey. It seems probable that the "persistent" type is the normal form for both sensation and after-image, and that the "flash" type, whether it occurs alone or as a member of the "double" type, is the result of the heightening of a liminal (or even subliminal) stimulus by movement of the screen across the field.

IV. Theoretical Discussion

Our results with the grey background are in agreement with the requirements of the Hering theory. The work with the black and white backgrounds, and with colors mixed with black or white as stimuli, indicate that: (1) the additional stimulation of the black process, with that for a given color, results always in a shift toward the red end of the spectrum; (2) the additional stimulation of the white process results in a shift toward the violet end of the spectrum; the amount of shift increases with an increase in the black-white process, until the color, already poor in chroma, becomes so dark or so light that it passes below the limen. Whether this result means that other color processes are actually stimulated, we cannot say. Nor can we say whether it means merely that certain brightnesses heighten the stimulating effect for certain colors, already physically present in the stimulus, at the expense of other colors also present. This question could be answered only by using physically pure stimuli, or those whose physical components were known. The problem presents no greater difficulties than does the mixture of black or white with colors seen at the fovea.

The shift in hue of sensations and after-images during fixation seems to indicate a greater instability of the peripheral retinal processes.

MINOR STUDIES FROM THE PSYCHOLOGICAL
LABORATORY OF VASSAR COLLEGE

XX. THE AFFECTIVE VALUES OF ARTICULATE SOUNDS

By LOUISE ROBLEE and M. F. WASHBURN

So far as we know, no attempt has ever been made to investigate experimentally the agreeable and disagreeable character of the sounds used in speech. It is obvious that apart from the associative power of words, the sounds which compose them may by their own pleasantness or unpleasantness exert a not inconsiderable influence on their literary value from an aesthetic point of view. Certain passages of poetry or prose are harsh or melodious in effect. It would seem a promising field in experimental aesthetics that is offered by the affective values belonging to articulate sounds.

The present study, of course, does not do more than effect an entrance into this field. The articulate sounds which we selected for study were combinations of an initial vowel and a final consonant. In order to get at the affective value of the sounds themselves, we chose from the syllables thus composed only nonsense syllables: had we used syllables with meaning, obviously the pleasantness or unpleasantness of the meanings would have wholly obscured that belonging to the sounds themselves. Of course we could not hope wholly to eliminate the meaning aspect, any more than is the case with memory experiments where nonsense syllables are used: a nonsense syllable is always likely to suggest something to the observer's mind. The *vowels* which we used were the following; a as in father, a as in fate, a as in hat, aw, e as in get, ee as in feed, i as in hit, i as in write, o as in hot, o as in wrote, oo as in boot, oi as in oil, u as in mud. The *consonants* were: *checks*, the hard labial p, the soft labial b, the hard dental t, the soft dental d, the hard guttural k, the soft guttural g; *breaths*, s, z, f, v, sh, zh, th; the *nasals*, m and n; *trills*, l. The list of syllables was made by combining each vowel as initial sound with each consonant as final sound, and then eliminating all the combinations that had meaning. The syllables thus chosen were pronounced in a fixed order, constant for all the observers, care being taken to use the same pitch and intensity of voice throughout. As the same person served as experimenter during the entire research, the conditions of pitch and timbre of voice were as constant as it is possible to make them. The order was such that the same sounds did not occur in successive syllables. The observer was asked on hearing a syllable to express her judgment as to its pleasantness or unpleasantness by using one of the numbers 1 to 7 in the usual way. The factor of affective contrast was of course present: if a given syllable was immediately preceded by a very pleasant or a very unpleasant one, its affective value would naturally be influenced in the opposite direction. Using a constant order for the syllables tended to make this factor constant for the different observers, but did not eliminate it: to do the latter would require a very long interval between successive syllables, which in turn would involve not only delay but also

variations in the condition of the observers and serious sources of error.

There were fifteen observers, all women, most of them untrained in introspection. Thirteen of them performed the entire experiment twice, at considerable intervals of time, affording an opportunity, as will be seen, for a study of the consistency of judgments made at different times on the same material.

The affective value of each vowel and each consonant was calculated by finding the average of the affective values assigned by all the observers to all the syllables in which the vowel or the consonant occurred. For the thirteen observers who performed the experiment twice, the averages were calculated separately for the first and second trials. The results thus obtained may be stated very briefly.

Vowels. The least agreeable vowel of those investigated is u as in mud, its average affective value for fifteen observers on the first trial being 2.9, mean variation .33; for thirteen observers on the second trial, 2.9, m. v. .34. Next above this stands the sound oi, with an average value of 3.4 on the first trial, m. v. .89; and of 3.3 on the second trial, m. v. .95. The very large mean variations here indicate the fact that the observers were less agreed as to the pleasantness and unpleasantness of this sound than as to that of any of the other vowels. Third came the sounds aw, whose average value on the first trial was 3.6, m. v. .49, and on the second trial 3.5, m. v. .40; o as in hot, whose average value on the first trial was 3.5, m. v. .28, and on the second trial 3.6, m. v. .36; and ee, whose average value on the first trial was 3.5, m. v. .46, and on the second trial 3.6, m. v. .51. Fourth came oo, with an average affective value on the first trial of 3.7, m. v. .4, and on the second trial of 3.5, m. v. .3; and i as in hid, with an average value of 3.6, m. v. .42, on the first trial, and of 3.6, m. v. .47, on the second trial. Tied for fifth place were a as in hat, with an average value of 3.8, m. v. .41, on the first trial, and of 3.8, m. v. .33, on the second trial; and i as in write, with an average value of 3.7, m. v. .41, on the first trial, and of 3.9, m. v. .53, on the second trial. Sixth stood a as in fate, whose average value for the first trial was 3.9, m. v. .68, in the second trial 3.9, m. v. .54. The next higher was o as in wrote, with an average value of 4.1, m. v. .32, in the first trial, and of 3.9, m. v. .17, in the second. Next to the highest in affective value was e as in get, whose average value for the first trial was 4.2, m. v. .36, and for the second trial 4.1, m. v. .36. And the most agreeable of all the vowels was a as in father, with an average value of 4.3, m. v. .53, on the first trial, and of 4.3, m. v. .43, on the second trial.

A better indication of the individual affective tendencies than is given by the mean variations of these averages may be found in the following statements. There were six out of the fifteen observers who found the vowel a as in father the pleasantest; five who found the vowel e as in get the pleasantest, three who found the vowel a as in fate the pleasantest, and one each who found o as in wrote and oi the most agreeable. There were eight observers who judged u as in mud the most disagreeable vowel, five who found oi the most disagreeable, two each who judged the most unpleasant vowel to be ee, aw, and a as in fate, and one who judged oo the most disagreeable. The fact that a as in fate and oi were by some observers held to be the most disagreeable and by others the most agreeable vowels is reflected in the large mean variations of their averages.

These averages are computed by averaging the averages of the

various judgments made by each observer on all the syllables containing the vowel in question. Evidently one and the same average furnished by a single observer may represent either a fairly constant judgment on all the syllables with the given vowel, or extreme judgments of an opposite and compensating character: in other words, our averages, while their own mean variations are given, have nothing to show the variations from the averages of which they are composed, and therefore may be very misleading as representatives of the preferences of our observers for different vowels. It seemed best for this reason to calculate the percentages of judgments of a high degree of pleasantness and unpleasantness for each vowel, that is, the percentages of judgments of 6 and 7 on the one hand and of 1 and 2 on the other. The order of diminishing pleasantness, beginning with the vowel which had the highest percentages of 6 and 7 judgments, was as follows: a as in father, e as in get, oo and a as in fate, o as in wrote, oi, i as in write, a as in hat, ee, i as in hit, o as in hot, aw, u as in mud. The order of diminishing unpleasantness, beginning with the vowel which gave the largest percentage of 1 and 2 judgments, was: u as in mud, oi, ee, oo, i as in hit and aw, o as in hot, i as in write, a as in hat, a as in fate, o as in wrote, a as in father and e as in get (same percentage). Oo seems to be a vowel which is the source sometimes of decided pleasantness and sometimes of decided unpleasantness, judging from its high position on both lists; the same is true of oi. I as in write, and a as in hat, on the other hand, are neutral vowels, seldom giving rise to extreme judgments of either sort.

Consonants. The most disagreeable final consonant, according to the averages, is g, average value on the first trials 2.4, m. v. .4; on the second trials, 2.3, m. v. .37. K comes next, its average value being 2.6, m. v. .4, on the first trials, and 2.5, m. v. .38, on the second trials. Next came sh, value 3.2, m. v. .87, on the first trials, and 3.1, m. v. .7, on the second trials; and t, value 3.2, m. v. .4, on the first trials, and 3.1, m. v. .4, on the second. The order of the rest was as follows: zh, first value 3.8, m. v. .79, second value 3.3, m. v. .66; b, first value 3.7, m. v. .4, second value 3.7, m. v. .4; d, first value 3.7, m. v. .5, second value 3.8, m. v. .37; f, first value 3.7, m. v. .48, second value 3.8, m. v. .37; p, first value 3.7, m. v. .39, second value 3.8, m. v. .34; z, first value 3.9, m. v. .67, second value 3.6, m. v. .57; s, first value 3.9, m. v. .5, second value 3.7, m. v. .32; th as in breath, first value 3.9, m. v. .57, second value 3.9, m. v. .51; th as in breathe, first value 4.1, m. v. .6, second value 4.1, m. v. .6; v, first value 4.2, m. v. .56, second value 4.1, m. v. .48; n, first value 4.3, m. v. .5, second value 4.5, m. v. .3; m, first value 4.6, m. v. .48, second value 4.3, m. v. .4; l, first value 4.8, m. v. .5, second value 4.8, m. v. .4.

Checking these results as we did for the vowels, we find that there were ten observers who found l the most agreeable of final consonants, three who found m the most agreeable, three who found n the most agreeable, and one each who preferred th as in breathe, s, and zh to all others. There were nine who thought g the most disagreeable final consonant, three who disliked sh more than any of the others, two each who found k and zh the most unpleasant, and one who disliked t most of all. When the percentages of 6 and 7 judgments and of 1 and 2 judgments were calculated, the order of diminishing pleasantness was as follows: l, m, n, th as in breathe, v, zh, th as in breath, d, z, s, p, sh, f, b, t, k, g. The order of diminishing unpleasantness was: g, k, t, zh, d, p, z, b, s, th as in breath, f, th as

in breathe, v, m, n, l. Zh seems to be a consonant which is sometimes decidedly pleasant and sometimes decidedly unpleasant; s and f are rather neutral, not furnishing a high percentage either of very pleasant or very unpleasant affective values.

A possible source of error in our method lay in the fact that each vowel was not used in combination with all the consonants in turn, for all combinations that had meaning were eliminated. Thus b, for instance, could be used as a final consonant with more vowels than t could, because fewer of its combinations made sense. Now it might happen that a particular vowel could be used only in connection with a group of consonants that happened to be pleasant ones, while the consonants used with another vowel, because they made meaningless combinations with it, might be particularly disagreeable ones. To investigate this influence, the average affective values were calculated of the vowels used with each consonant, and of the consonants used with each vowel. The average value of the consonants used was 3.6 in the case of all the vowels but two; for e as in get it was 3.7, and for aw it was 3.5. The former was therefore slightly helped by the fact that it was used with rather more agreeable consonants, while aw lost a little through the influence of its associated consonants. The effect of the consonants must, however, have been very slight, and by no means enough to account for the positions of these vowels in the series of affective values. The average value of the vowels used was 3.6 for all the consonants except the following: l, p, and v, 3.7; d, 3.5, t, 3.4. Thus l, the most agreeable consonant, was somewhat helped by its vowels, and t would undoubtedly have had a higher place had it been associated with pleasanter vowels. On the whole, however, the fact that the associated letters differed for different vowels and consonants seems to have had no important influence on their affective values.

A curious uniformity is apparent when the mean variations for the first series of trials are compared with those for the second series of trials. There were seventeen consonants used, and in the case of none of these is the mean variation for the second series of trials larger than that for the first series. In the case of fourteen, the second-series mean variation is smaller than the first-series mean variation: in the other three cases both mean variations have the same value. It seems hardly possible that such uniformity can be without significance and due to accident. A possible explanation for it would be to suppose that associations played a greater part in the first set of tests made by each observer, and that as associations differ for different people, there was less agreement among the individual observers in the first series. In the later tests, it may be argued, practice enabled the observers to base their judgments on the affective character of the sounds themselves, regarding which there is, we should have to conclude, a greater degree of unanimity among different persons. The mean variations for the vowels do not show the same tendency. May it perhaps be true that associations are more persistent in their influence on the affective character of vowel sounds? We have not the data on which to base a positive conclusion with regard to this matter.

The Self-Consistency of the Observers. A chapter in experimental aesthetics should deal with the self-agreement of an observer in judging the pleasantness or unpleasantness of given material at different times. Of course the causes of variation are often to be found in conditions, such as the physical state of the observer or accidental

reasons for high or low spirits on his part, but other factors might be investigated whose laws could be more easily ascertained. For instance, in using our method, it may be asked what kind of judgments an observer is least likely to change at a second experience: if a syllable has been assigned an extreme affective value, 7 or 1, at the first trial, will this judgment be more or less subject to revision than if it had been assigned a moderate affective value, 3 or 5, or had been a judgment of indifference, 4? Are we more likely to change our minds with regard to our extreme likes and dislikes or with regard to our moderate ones?

To investigate this point, we first counted the number of judgments of each kind (1, 2, 3, 4, 5, 6, and 7) made by each observer, and then, counting the number of these judgments which were unaltered in the second series of experiments made by the corresponding observer, we calculated the percentages. It is essential to note that the observers never reported remembering their previous judgment on a syllable, and the syllables were so numerous that such recollection would not be likely to occur often. The number of judgments of 1 and 7 was so small that the percentages calculated for them are not trustworthy. But the results showed quite plainly that the degree of constancy was greater for the judgments of a slight degree of pleasantness or unpleasantness (3 or 5) than for the judgments of a fairly high degree (2 or 6). It would seem that, under these experimental conditions, when we have asserted a considerable degree of affective reaction to an impression, we are more likely to change our minds at a later trial than when we have asserted only a moderate degree. With regard to the judgment of indifference, 4, the case is somewhat peculiar. Some observers rarely make it, and indeed the *Aufgabe* of the experiment, which demands of the observer an affective reaction, works against the occurrence of this judgment. Observers of this type, who make sparing use of the judgment 4, have a strong tendency to change it on the second trial. On the other hand, if an observer has no hesitation in pronouncing a syllable indifferent on the first trial, she has a strong tendency to make the same judgment at the second trial.

Summary. The most agreeable vowels in combination with a final consonant are a as in father and e as in get; the most disagreeable is u as in mud. The most agreeable final consonants are l and the nasals m and n; the most disagreeable are the gutturals g and k. There is most disagreement among the observers with regard to the affective value of a as in fate, oi, and oo, among the vowels: zh is the consonant with regard to which there is least unanimity. The vowels i as in write, and a as in hat, and the consonants s and f, are neutral, seldom occasioning judgments of extreme pleasantness or unpleasantness. In the case of the consonants, the thirteen observers who were tested twice showed more unanimity in the second trials than in the first ones: a possible explanation would lie in the falling off of associative influences with practice. If this explanation is true, the vowels must preserve their associations longer than the consonants, for no increase in unanimity is observable in their averages between the first and second trials. The observers changed their minds on a second trial less in regard to the moderate judgments 3 and 5 than in regard to the more extreme judgments 2 and 6. Observers who readily used the indifferent judgment 4 tended to abide by it: those who used it sparingly tended to change it at a second trial.

BOOK REVIEWS

The Mafulu Mountain People of British New Guinea. By R. W. WILLIAMSON. With an Introduction by A. C. Haddon. London, Macmillan & Co., 1912. pp. xxiii, 364.

Readers of Dr. Seligmann's great work will remember the statement that "the mountains inland of Mekeo, Nara and Kabadi are inhabited by a number of tribes of whom our knowledge is extremely limited." Mr. Williamson, by his investigation of the Mafulu people, has now made a very valuable addition to that knowledge. The Mafulu inhabit a number of villages in the mountainous hinterland of the Mekeo district,—almost due east of Cape Possession, and almost cut by a line drawn from the north end of Yule Island to Mt. Albert Edward. They have had but the slightest contact with Europeans; practically none, indeed, before the establishment of the Catholic Mission five years previous to Mr. Williamson's visit. They therefore offered an admirable field for ethnological study. Mr. Williamson had the ungrudging assistance of the Mission Fathers, and has collected a great deal of information. Much more, of course, remains to be done; while the peoples living still further back in the mountains, the Ambo and Boboi and Oru Lopiku, yet await their investigator.

The rules of ethnographical enquiry have now been fairly standardised, and the present work might serve as a paradigm of accepted methods. But Mr. Williamson was fortunate enough to make a real discovery. He has "shown strong evidence that the Mafulu and probably other adjacent mountain tribes are essentially a pygmy—that is to say a Negrito—people who have been modified to some extent by Papuan and possibly Papuo-Melanesian influence, both physical and cultural" (Haddon); and he believes "that the negrito element is derived from an original ancestry who were probably the earlier inhabitants of New Guinea." The discovery is confirmed by the results of the expedition sent out by the British Ornithological Union to Dutch New Guinea in 1909, which was on the ground at the same time as Mr. Williamson; we learn in Mr. Wollaston's recent book on *Pygmies and Papuans: the Stone Age To-day in Dutch New Guinea* of a west-end pygmy stock, the Tapiro, which is evidently less mixed than Mr. Williamson's Mafulu. Ethnologists had, of course, had their suspicions; but our author raises presumption to practical certainty; and he well deserved his good fortune, since—as Dr. Haddon tells us—"he was unwell during the whole of his time in New Guinea and had an injured foot and leg that hurt him every step he took."

For the rest, the book will go on our shelves as a mine of comparative detail. Mr. Williamson gives an excellent account of the structure of the village club-houses or *emone*, and of the most important function of a community of villages, the Big Feast, which he regards, in origin, as a ceremony for finally 'laying the ghosts' of the chiefs whose bones are dipped in the blood of the slain pigs. He thinks that music "is usually more indigenous in hill country than it is in the plains," and finds that the Mafulu are correspondingly more musical than the Mekeo; they have the drum, a jew's-harp, and a small flute,—the latter probably borrowed from the Mekeo. There is no sign of

totemism: "I was unable to discover the faintest trace of any idea which might be regarded as being totemistic, or having a totemistic origin." This fact, interesting in itself, is rendered the more interesting by the parallel observation that "art and design among the Mafulu people are only of a simple and primitive type." As one passes from coast and plains to the hills, there is "a sudden drop from artistic designs embodying curves and natural imitative art to a system confined to straight lines, zigzags, and spots:" this in spite of a "contact which has certainly existed for some time back." The author concludes, reasonably enough, that the lack of imitative art "is partly due to the absence of totemism and of the imitative stimulus which, as Dr. Haddon has more than once pointed out, arises from it."

The volume is well illustrated by 91 photographic plates and 10 figures in the text; there is also a good map. There are five linguistic appendices by Messrs. Ray and Strong, largely based on the work of the Rev. Father Egedi and the Rev. E. P. Money. E. B. T.

The Gateways of Knowledge: an Introduction to the Study of the senses. By J. A. DELL. Cambridge, The University Press; New York, G. P. Putnam's Sons. 1912. pp. xii, 171. Price \$1.50.

This little book contains a number of elementary exercises in experimental psychology, with parallel reference to anatomy and physiology. After an introduction dealing with the Meaning of Observation, the following topics are discussed: the Brain, Nerves and Organs of Sense; the Cutaneous Senses; the Machinery and Experience of Movement; Taste and Smell; Sound and Hearing; Light, the Eye, and Sight; Action; and Memory. The work is intended for pupils of about 12 to 15 years of age, and the experiments and materials are much simpler than those, *e. g.*, of Seashore's *Elementary Experiments in Psychology*. The author is plainly an enthusiast for his subject; he writes with clearness, and yet without shirking difficulties of subject-matter and of method; and some of his devices, as well as some of the additional exercises appended to the various chapters, are most ingenious. It should be said, however, that there are additional exercises which call for more knowledge than is imparted in the text.

The book is, I believe, the first of its kind; it marks a new departure in Great Britain; and it will, no doubt, pass through a number of editions. For these reasons I think it worth while to offer suggestions and criticisms in some little detail.

The author rightly distinguishes the questions "How does the sense-organ work?" and "What does it feel like to see (hear, taste, etc.)?" Yet his psychological exercises rarely take the form 'what does it feel like;' for the most part they give answers to the questions "How delicately or accurately can we feel?" and "What information regarding the outside world do we get by seeing, etc.?" Here is a confusion (witnessed by the 'sensations of heaviness, whiteness' and the like on page 2, and by the 'two sensations' received from a pair of gloves on page 22) which, one would suppose, an intelligent pupil must remark, and which also detracts from the scientific value of the work; a standpoint, once chosen, should be adhered to. Passing to special points, I suggest that needles might be replaced by bristles in the aesthesiometric experiment. Short hog's bristles, with points rounded by burning, serve the purpose; the same bristles may be used for the detection of pressure spots,—which the author does not mention, though he refers to cold and warmth (erroneously called heat) spots. The silk threads of the touch-weights should be fixed by sealing-wax to

the ends of matches; the use of the bare silk is inconvenient. I doubt whether warmth spots can be found by the method given (p. 34). The sensation of pain should not be confused with unpleasant feeling. On page 39 text and figure are not in agreement; the figure on page 45 has no letter D; the figure on page 96 needs further explanation, since the retina appears to be continued into the zonule of Zinn. On pages 58-9 there is a confusion of letter and packet. On page 60 Weber's Law appears without explanation as the Weber-Fechner Law (see pp. 29 f.). On page 63 there is confusion of adaptation with fatigue; and the night-blindness of the fovea is ignored. It is not correct to say that the internal ear "consists of cavities in the ear bone." The English of Hörmesser is acoumeter. On page 83, 1906 should be 1905. The neglect of contrast and adaptation on pages 108 f. is remarkable. The phrase "unconscious use of the imagination" (p. 126) is not scientific. On page 131 'several times' should be 'twice.' The reference to Sanford on page 135 will mislead the pupil; the method goes back to Helmholtz and Aubert. The norm of 0.27 sec. on page 150 is seriously misleading. The graph on page 153 omits three determinations, and the 40 per cent. is evidently a mistake.

These are small matters, which the author, if he will, can readily change. I suggest, further, that a qualitative aesthesiometric experiment be introduced, in which the observer is not confined to the judgments 1 and 2; and that experiments on visual contrast and adaptation be added. There is much cheap apparatus of which the author is apparently unaware. Thus Nagel's cards serve excellently for the diagnosis of color-blindness; it is unnecessary to pay \$30 for the Edridge Green lantern. The spectrum-chart saves the expense of a spectroscope. I assume that the whirling-table is to be borrowed from the Physical Laboratory; but borrowing and lending are ticklish things; and Mr. Dell will find that a mechanical mixer of the Hering type can be built very cheaply from odd wheels to be picked up at any machine-shop. The mixer will then serve for a number of experiments, and will replace the whirling string of ex. 72. Nendel has some cheap materials for visual sensation; my own adaptation frame (*Text-book*, p. 73) may be made at home for next to nothing; and an admirable demonstration of contrast may be given with black, white and grey papers, mounted on a folding card like a Japanese screen. I understand that Münsterberg's Pseudoptics is, unfortunately, off the market; many interesting optical illusions may, however, be shown by means of black and white cards and paper-fasteners. Galton's weights may be copied by weighted pay-envelopes or cartridge-cases.

E. B. T.

Modern Science and the Illusions of Professor Bergson. By H. S. R. ELLIOT. With a preface by Sir Ray Lankester. New York and London, Longmans Green & Co., 1912. pp. xix, 257. Price \$1.60 net.

This little book contains a spirited, not to say a violent attack upon the philosophical teaching of M. Bergson. An Introduction points out the futility and incomprehensibility of all metaphysics, and represents Bergson as attempting a mediation between mechanism and teleology. Ch. II sets forth the leading doctrines of the *Creative Evolution* and the *Matter and Memory*. Ch. III gives the author's reasons for dissent. Bergson is guilty of three fallacies: he thinks that disproof of rival theories is proof of his own; he is addicted to false analogies; he makes deductions from questionable premises. He is chargeable, further, with hopeless and irremediable misuse of language. In par-

ticular he fails to show (1) that time is a stuff both 'resistant and substantial;' (2) that consciousness is to some extent independent of cerebral structure; and (3) that instinct leads us to a comprehension of life which intellect could never give. Ch. IV reviews the progress of philosophy, with the help of Lewes and Lange; traces the gradual growth of the mechanistic theory of the universe; and decides that philosophy fails in its search for final truth. Ch. V upholds the automaton theory as against McDougall. Ch. VI traces the origin of fallacies to primitive and congenital tendencies to believe, tendencies which weaken with evolution, so that the fully developed brain of man approaches an impartial *tabula rasa*. Ch. VII defines the true province of philosophy as increase of positive knowledge (this is, however, more correctly referred to science) and dissipation of error, the break-up of erroneous intuitions about conduct.

It is, perhaps, needless to say that the author is tarred with his own critical brush. He will hear nothing of metaphysics, yet he formulates a metaphysical attitude (p. 229 and elsewhere); he will hear nothing of epistemology, yet he commits himself to a theory of knowledge (p. 220 and elsewhere). But with all his constructive weakness there can be no doubt that his criticism is in large measure effective; and his outspoken protest against Bergsonian mysticism is wholesome. Many of us feel, with the writer of the preface, that "M. Bergson is gifted with an admirable facility of diction, and has succeeded in arresting attention. On that account, since he has exceeded the limits of fantastic speculation which it is customary to tolerate on the stage of metaphysics, and has carried his methods into the arena of sober science, it is a matter of urgency that his illusions and perversions should be exposed with uncompromising frankness." The book will probably make for good; but the last word must be left to the philosophers *von Fach*.

A Manual of Mental Science. By L. M. WHIPPLE. New York, Metaphysical Publishing Co., 1911. pp. 221. Price \$1.

This little book has a practical as well as a theoretical side. For "Exact Thinking renders Mental Healing possible, sure and safe." Let us, then, begin to think exactly. We come upon such verities as that Truth contains no error; that Of two contradictory opposites or statements both cannot in any event be true; that Something from Nothing is impossible,—nay, more, that Something cannot be produced from nothing; that the Substance of Nothing is vacancy. Continuing our efforts, we discover that Man is spiritual in essence but mental in action; that there is no Source of evil or disease; for disease proceeds only from incorrect thinking, and its cause is always mental; so that the Mentality is the only Source of sickness. On the basis of such Exact Thinking, the author formulates Rules for Living, for Character, for the Home, for Business and for Health.

Across Australia. By BALDWIN SPENCER and F. J. GILLEN. In two volumes. London, Macmillan & Co., Ltd.; New York, The Macmillan Co. With illustrations, maps and plates. 1912. Vol. i., pp. xiv., 254; vol. ii., pp. xvii., 255-515. Price \$7 net.

Messrs. Spencer and Gillen are the joint authors of two very valuable works upon the ethnology of Central Australia,—*The Native Tribes of Central Australia* (1899) and *The Northern Tribes of Central Australia* (1894); the former book has, unfortunately, been

allowed to go out of print. The volumes now before us record no new investigations; they recount, in more or less popular form, a traverse of the continent from Oodnadatta in the south to the Gulf of Carpentaria in the north, and thus generalize and condense the travels and labors of the authors upon several separate journeys. Geographical features, climate, fauna and flora, are set forth in vivid and entertaining fashion; and the reader's interest is held by such incidents as the discovery of a true crab on the dry steppes or of a Central Australian honey-ant like that of Colorado and Mexico, by the description of a palaeolithic feast (129 ff.), by tales of early exploration and settlement, and by good-humored stories of the accidents and discomforts of camp life. The social organization, customs, beliefs and ceremonial observances of the various tribes—from the Urabunna through the celebrated Arunta, the Kaitish, Unmatjera, Warramunga, Tjingilli, Umbaia and Binbinga, to the coastal Anula and Mara—are explained with sympathy and understanding, though, as is natural in a popular work, a multitude of details and many cardinal points, familiar to readers of the more technical works, have been omitted. The book as a whole offers an admirable introduction to the ethnology of Central Australia; it gives the earlier volumes a background and perspective whose absence, realized but dimly when they were first read, can now be seen to have been a serious deficiency. It shows, more especially, how the writers obtained their information and their photographs: both of them were considered as fully initiated members of the Arunta tribe, and were known familiarly to their fellow-tribesmen as "stomach" and "little stomach"—we learn that on one occasion their respective capacities were thirteen and six eggs at a meal; both were therefore allowed and even invited to be present at the most sacred ceremonies; and the natives were everywhere friendly,—the Tjingilli, for instance, actually sending messengers on ahead, without saying anything about it, to tell the Umbaia that the visitors were coming and were to be well treated.

The two volumes are lavishly illustrated, though (unless I am mistaken) all the cuts, with the exception of some views of scenery, have been published elsewhere. There are a few signs of haste, or perhaps of the dual authorship, as in the repetition of the note on porcupine grass (110, 145; there are other similar repetitions) and in the discrepancy of the dimensions assigned to Ayers Rock (111, 113 f.). In general, however, the writing is as careful as it is interesting, and the work may be cordially recommended.¹ E. B. T.

The Life of Nietzsche. By ELIZABETH FOERSTER-NIETZSCHE. Vol. I. The Young Nietzsche. New York, Sturgis and Walton Co., 1912. pp. xi, 399. Price \$4.

This, the first volume of a popular biography of Nietzsche, covers the happy years from 1844 to 1876; the second and concluding volume will show us the other, *The Lonely Nietzsche*. We read here of Nietzsche's childhood: he lost his father when five years old, and was brought up in a feminine household, with grandmother, mother, two aunts and his only sister. We read further of his school days at Pforta, with their scrapes and successes; of his year at Bonn, and

¹Since this notice was written, anthropology has suffered a serious loss by the death of Mr. F. J. Gillen. It seems strange that while Professor Spencer received the well-earned honor of a C. M. G., Mr. Gillen—a special magistrate and sub-protector of aborigines, and precisely the type of official that one would suppose the imperial authorities desirous to encourage—should have gone unrewarded.

the unhappy membership in the *Franconia*; of his following of Ritschl to Leipzig, where he spent two pleasant and profitable years, busy with Schopenhauer, music and the Philological Club, and where he met Wagner for the first time; of the year's soldiering and the unfortunate accident that marked it; and of the unexpected call to Bâle as assistant professor of classical philology. Nietzsche entered on his university duties in 1869, and was promoted to a full professorship in 1870; he saw much of the Wagners at Tribschen; and everything was going well when the war broke out. A naturalised Swiss subject, Nietzsche nevertheless volunteered his services to his fatherland, and was accepted as an ambulance nurse; after a few weeks in the field he was stricken with serious illness, which permanently undermined his health. Returning to Bâle, he published the *Birth of Tragedy* (end of 1871). The rest of the tale is taken up with ill-health, due to eye-strain, and with journeys made in the hope of restoration; with the life at Bâle in company with his sister; with the abortive essay toward marriage; with the publication of the four tracts *Thoughts out of Season*; and with the final visit to Bayreuth and the culmination of the revolt from Wagner. Nietzsche has now bidden farewell to his two youthful ideals, Schopenhauer and Wagner, "and must walk unaccompanied along the hard solitary road of his manhood."

The book is interestingly written; and though the present reviewer faced the large octavo volume of 400 pages with some misgivings, he has read it through with enjoyment. A dozen photographic illustrations add to its value.

Introductory Philosophy: a Text-book for Colleges and High Schools.

By C. A. DUBRAY. New York, Longmans Green & Co., 1912. pp. xxi, 624.

Within the compass of 600 octavo pages the author gives us a General Introduction (on the nature of philosophy and on the general view to be taken of the world and of man), an empirical psychology, a logic, an aesthetics, an ethics, an epistemology, a cosmology, a rational psychology, a theodicy, an outline of the history of philosophy, and a General Conclusion (on the universe, on man, and on God). The book is written from a consistent point of view, and with an experienced teacher behind it may serve as a work of systematic reference. As a text-book it hardly commends itself; the style is arid, and the connection of paragraphs, as is natural from the brevity of the exposition, is by no means always clear. To the present reviewer the work seems totally unfitted for high-school use. And college students would probably learn more from introductory courses in psychology, logic and ethics, followed in later years by separate courses in the less empirical disciplines and in the history of thought, than from such a compendium as Dr. Dubray has here provided.

BOOK NOTES

The realm of ends, or pluralism and theism. By JAMES WARD. New York, G. P. Putnam's Sons, 1911. 490 p.

The chief chapters are: the one and the many, pluralism, its difficulties. This constitutes the first part, headed pluralism. The second, headed theism, treats of the idea of creation, cosmology, theism, freedom, its relations to foreknowledge, the problem of evil and pessimism and optimism, moral evil and moral order, thoughts of a future life, faith and knowledge, realm of ends.

A system of psychology. By KNIGHT DUNLAP. New York, Charles Scribner's Sons, 1912. 368 p.

For a text-book, this is a vigorous, interesting and ingenious presentation of the topics which lie within its scope. After a preliminary analysis of content, the author treats of sensation in general, its quality, thresholds, sensation intensity, protensity and extensity of sensation, local significance, relational elements in the content of consciousness, ideas as elements of content, retention, memory and recall, association, perception, affective content or feeling, action and will, self or empirical ego, degrees of consciousness, its time relations, the subconscious, the ego, the occult.

An introduction to psychology. By WILHELM WUNDT. Translated from the second German edition by Rudolf Pintner. London, George Allen & Co., Ltd., 1912. 198 p.

This is a shorter and slighter sketch than the same author's outlines and it has had enormous popularity in Germany. There are only five chapters treating of consciousness and attention, the elements of consciousness, association, apperception, and the laws of the psychic life.

Neue Lehre vom zentralen Nervensystem. Von EM. RÁDL. Leipzig, Wilhelm Engelmann, 1912. 496 p.

After discussing the difference between the old and new neurology, the author enters upon a consideration of the eyes of animals, then of the nervous centers in general, types of visual centers, the asymmetry of these optical centers, cascade fibres, invertebrate nerve tracts and ganglia, the retinal layer and sensitiveness to light, length of the nervous tract, and finally the new doctrine in general with its greater unity of plan.

Die neue Tierpsychologie. Von GEORGES BOHN. Leipzig, Veit & Co., 1912. 183 p.

This essay won a prize of the Paris Academy of Moral and Political Science and is here presented in a German edition. The original bore the title The Origin of the Ability to Think. The author's chief endeavor is always to base psychological upon biological processes and to show the new light in which these latter stand when they are related to psycho-chemical processes. The author assumes that the idea of science is systematic thought and that mechanism is determinism.

Das Inzest-Motiv in Dichtung und Sage. Grundsätze einer Psychologie des dichterischen Schaffens. Von OTTO RANK. Leipzig, Franz Deuticke, 1912. 685 p.

This work is very properly dedicated "in gratitude to my highly revered teacher Sigismund Freud." The writer has been working on this topic since 1906 and it is a very comprehensive and thorough-going work. In the first section, he discusses the relations between parents and children, the individual roots of the incest phantasy, its type in dramas such as Oedipus, Hamlet and Don Carlos; then in its appearance in Schiller, the step-mother theme, Byron's Parisina, the scheme of the Phaedra, the conflict between father and son, Shakespeare's father complex, the Oedipus drama; and in its relations to the literature of the world, its meaning, the incest complex in ancient myth and tradition, Middle Age fables and Christian legends which illustrate it, the relations between father and daughter in myth, saga, Märchen, poetry, life and neuroses, and incest in historical times. The second part treats of the relations between brother and sister and the significance of this complex, how it appears in Grillparzer, the "Ahnfrau" scheme, as seen in Calderon, Voltaire, Goethe's love of brother and sister, its difficulties and stages of development, Byron's relation to this theme, biblical material, how it appears in the literature of Lope, Calderon, Cervantes, Schiller's complex, the brother hate complex as seen in Socrates and Schiller, the tragedies of fate, romanticists like Tieck, von Arnim, Körner, Wagner, the incest motive in modern poetry as seen in Ibsen and contemporary poets.

The mechanistic conception of life. By JACQUES LOEB. Chicago, University of Chicago Press, 1912. 232 p.

These essays were written on different occasions, mostly in response to requests for a popular presentation of the results of the author's investigations. The titles characterize their general tendency as an attempt to analyze life from a purely psycho-chemical viewpoint. Repetition is unavoidable to perhaps any view of the technical nature of the subject. This may not be detrimental. The ten chapters are as follows: the mechanistic conception of life; the significance of tropisms for psychology; some fundamental facts and conceptions; concerning the comparative physiology of the central nervous system; pattern adaptation of fishes and the mechanism of vision; on some facts and principles of physiological morphology; on the nature of the process of fertilization; on the nature of formative stimulation (artificial parthenogenesis); the prevention of the death of the egg from the act of fertilization; the rôle of fertilization in the preservation of life; experimental study in the influence of environment on animals.

Grundsätze der Psychophysiologie. Von ALFRED LEHMANN. Leipzig, O. R. Reisland, 1912. 742 p.

All psychologists will welcome this concise text-book by this well known author. We have no space to do justice to the work here. The first book treats of the relations of body and soul, beginning with conscious phenomena, energy and its transformation, life and its operations, the nervous system. The second book is on psychophysics and deals with sensations, visual, auditory, feelings and the rest. The third is devoted to psychodynamics and deals with inhibitions and Bahnung. Then psychic activity, such as attention, discrimination, association, is taken up. Then come psychic complexes like time, space, the ego and Affekte.

Women's position in the laws of the nations. A compilation of the laws of different countries, prepared by the I. C. W. Standing Committee on Laws concerning the Legal Position of Women, with an introduction by Mme. d'Abbadie d'Arrast. Karlsruhe i. B., G. Braun, 1912. 192 p.

This publication grew out of a resolution passed at the Fourth Quinquennial Meeting of the International Council of Women at Toronto in June, 1909, calling for a report of the existing unequal laws in various countries which deal with the relation of women to the home, family, municipality and state. The reports are from a score of countries and each is made by some woman expert in that country. The work concludes with a history of the International Council, a list of its affiliations, committees, etc. The report appears in three languages, English, French and German.

Die Ursachen der jugendlichen Verwahrlosung und Kriminalität. Von HANS W. GRUHLE. Berlin, Julius Springer, 1912. 454 p.

This is a very comprehensive and thorough treatise on its subject, beginning with the fate and personality of the child, relations between ability and environment, and then taking up the different classes of defect. The volume abounds in curves, tables and statistics, and practical suggestions. Its periscope of cases, institutions and literature is wide.

Bau und Leben der Bakterien. Von WILHELM BENECKE. Leipzig, B. G. Teubner, 1912. 650 p.

This comprehensive and thoroughgoing work will perhaps have little interest for most psychologists, although the chapters that deal with the life histories of bacteria, their vitality and conditions of life, etc., will be interesting to all.

Das energetische Imperativ. Von WILHELM OSTWALD. Leipzig, Akademische Verlagsgesellschaft, 1912. 544 p.

We have here an attempt of this well known author to systematize his thought and show its philosophical basis and the kind of social organization that is built upon his thought. He has much to say of relations of organization and internationalism, of educational institutions and theory, and closes with a group of biographies. It is not a systematic work, but cannot fail of course to be stimulating and suggestive.

Zur Psychologie der Aussage. Ein Vortrag. Mit einem Anhang: Ueber die gesetzliche Beseitigung des Zeugnoids. Von JOHANN GEORG GMELIN. Hanover, Helwing, 1909. 98 p. (Zweite Auflage.)

The author first treats the subject in general and then the legal setting aside of the oath of witnesses and concludes with a general summary of opinion concerning the whole subject.

Elemente der Völkerpsychologie. Von WILHELM WUNDT. Leipzig, Alfred Kröner, 1912. 523 p.

This book is not an epitome of the five volumes of *Völkerpsychologie*, although it covers much the same ground, but it is a new and independent work of a more popular character, which seems to be particularly adapted for a translation into English, which we hope may soon be forthcoming.

Das Gefühl. Von THEOBALD ZIEGLER. Leipzig, G. J. Göschen, 1912. 402 p.

This is a fifth and revised edition of this well known work, the first edition of which appeared in 1893.

The N. E. A. phonetic alphabet with a review of the Whipple experiments. By RAYMOND WEEKS, JAMES W. BRIGHT and CHARLES H. GRANDGENT. Lancaster, Pa., The New Era Printing Co., 1912., 91 p.

This compact little pamphlet is more than a controversial book, although it enters upon a rather sharp polemic against Professor Whipple and seeks "to point out how far from conclusive and in fact misleading at times are the results reached by" him. It is an explanation and discussion of the principles which underly what is known as the scientific key alphabet for use in respelling for pronunciation, dictionaries, encyclopedias, school books, etc.

Backward and feeble minded children: clinical studies in the psychology of defectives with a syllabus for the clinical examination and testing of children. By EDMUND BURKE HUEY. Baltimore, Warwick & York Inc., 1912. 221 p. (Educational Psychology Monographs.)

The author of this work has had an admirable training and this book was well worth writing. The chief topics are classification and terminology, clinical studies of border cases, translation of the data, selected groups, lines of transition from feeble mindedness to non-feeble mindedness, a syllabus for the clinical examination of children, mental functions to be tested and observation, with bibliography, index of cases, subjects and of names.

Denkende Tiere. Von KARL KRALL. Leipzig, Engelmann, 1912. 532 p.

This is a comprehensive account by their master of the famous thinking horse, Hans and his successors, Muhamed and Sariff and bears the subtitle of contribution to knowledge of the animal soul on the basis of original investigations. After treating of the horses in detail, the third part describes how to instruct horses as based upon the experimenter's experience.

Zentralblatt für Psychoanalyse. Herausgeben von Dr. SIGM. FREUD. Schriftleiter Dr. Wilhelm Stekel. I. Jahrgang, Heft 1/12. Wiesbaden, J. F. Bergmann, 1911.

Archives sociologiques. Publiées par Émile Waxweiler. Institut Solvay. Institut de Psychologie. Bulletin 19, 3^e Année, 25 Mars 1912. pp. 301-617. (Contributions nouvelles aux Archives Sociologiques.)

A comparison of personal characteristics in dementia praecox and manic-depressive psychosis. By EARL D. BOND, M. D. and E. STANLEY ABBOT, M. D. Reprinted from American Journal of Insanity, vol. 68, January 1912. pp. 359-360.

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- The Hamlet problem and its solution.* By EMERSON VENABLE. Cincinnati, Stewart & Kidd Company, 1912. 102 p.
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- Das Problem der Funktionen des Nervensystems.* Von S. BAGLIONI. Jena, Gustav Fischer, 1912. 50 p.
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- The founders of modern psychology.* By G. STANLEY HALL. New York, D. Appleton & Co., 1912. 471 p.
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- Philosophische Betrachtungen: Fragmente aus dem literarischen Nachlass.* Von GUSTAV LEVINSTEIN. Berlin, Leonhard Simion Nf., 1912. 99 p.
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- Psychologie und Medizin.* Von O. KÜLPE. Leipzig, Wilhelm Engelmann, 1912. 81 S. (Sonderdruck aus der Zeitschrift für Pathopsychologie. 1. Band.)

NOTE

On the occasion of his eightieth birthday, August 16, 1912, Professor Wundt was presented by some sixty of his former students and other friends with the sum of Mk. 7000, to constitute a *Wilhelm Wundt Stiftung* of which he should dispose at his discretion. After expressing his thanks for the gift, Professor Wundt declared his intention of employing the sum for the purchase of instruments in the domain of psychological acoustics and phonetics, and of depositing the instruments in the Leipzig Laboratory. Experimental psychology, he remarks, may render service in this field to such related disciplines as linguistics, social psychology, and the science of music. The apparatus will bear the mark of the *Stiftung*, and the names of contributors will be preserved in the archives of the Laboratory.

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